

16P-512-101
Game No. 512
September, 1982

VARKON



FOR SERVICE...
NOTE NEW TOLL-FREE TELEPHONE NUMBERS:

800-621-1253
IN ILLINOIS CALL:
800-572-1324



ELECTRONICS, INC.
3401 N. California Ave., Chicago, IL 60618
Cable Address: WILCOIN, CHICAGO
(312) 267-2240

SPECIAL CONSIDERATIONS WHEN REPLACING CIRCUIT BOARDS

CPU Board
1. Revision level 7 CPU Boards (batteries located on lower left corner at board) or later boards must be used.
2. Must be equipped with blue-labeled Flipper ROMs and blue-labeled Game ROMs.
3. Jumpers W3, W10, W11, W14, W17, W19, W20, and W22 must be connected. Jumpers W4, W9, W12, W15, W16, W18, W21, and W23 must be removed. With the exception of W25, (Factory Setting Jumper) all other jumpers are not changed.

Sound Board
Must be jumpered for ROM operation and be equipped with Sound ROM 10. (Jumpers W2, W5, W7, W9, W10, W12, and W15 connected; W3, W4, W6, W11, and W13 removed).

Power Supply Board
1. Model D 8345 board required (equipped with relay).
2. Fuse F4 (10A SB) for flipper solenoids must be installed.

Display Boards
Model C 8363 Master Display and 7-digit Slave Displays required.

CONTENTS

Game Setup

1. Open cash box door and remove cash box.

2. Open cash box and remove play balls for insertion in game.

3. Open rear door and remove power cord; insert it in notch cut in bottom of door frame.

4. Place one play ball into Upper Playfield outhole.

5. Open coin door.

6. Reach through coin door & remove two wing nuts (marked by hanging tags) holding Lower Playfield in position.

7. Place one play ball in Lower Playfield and replace Lower Playfield with wing nuts.

Inspection

1. Check all cable connectors for loose wire terminations. Reseat any loose wires by pushing in on terminal.

2. Push on all connectors attached to Master Display, CPU, Power Supply, Driver, and Sound Boards, and check terminations on Power Input Board capacitor and bridge rectifiers at bottom of cabinet.

3. Gently press on all socketed IC packages on circuit boards.

4. Check all fuses: 2 on Sound Board, 7 on Power Supply Board, and line fuse on Power Input Board (on cabinet floor).

5. Push on connectors attached to Slave Display Boards.

6. Check coin door interlock switch and diagnostic switches wire terminations.

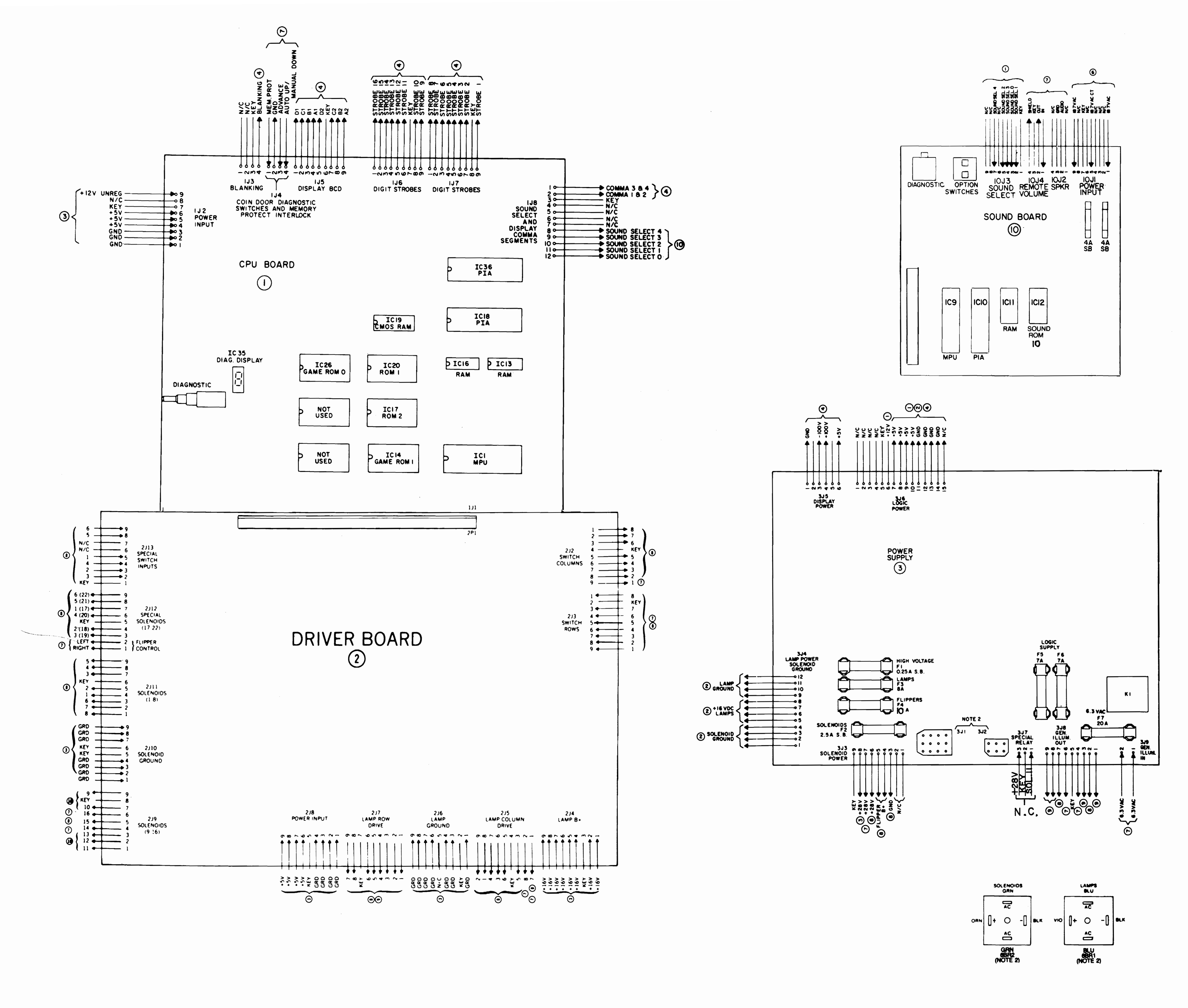
Power Turn-On

CAUTION - This game must be plugged into a properly grounded outlet to prevent shock hazard and to ensure proper game operation. DO NOT use a "cheater" plug to defeat the ground pin on the line cord, and DO NOT cut off the ground pin.

1. Carefully inspect rear door printed circuit boards and displays, cabinet wall printed circuit boards and cabinet floor Power Input Board to see they are securely mounted in place.

2. Close and lock rear door, cash box door, and coin door.

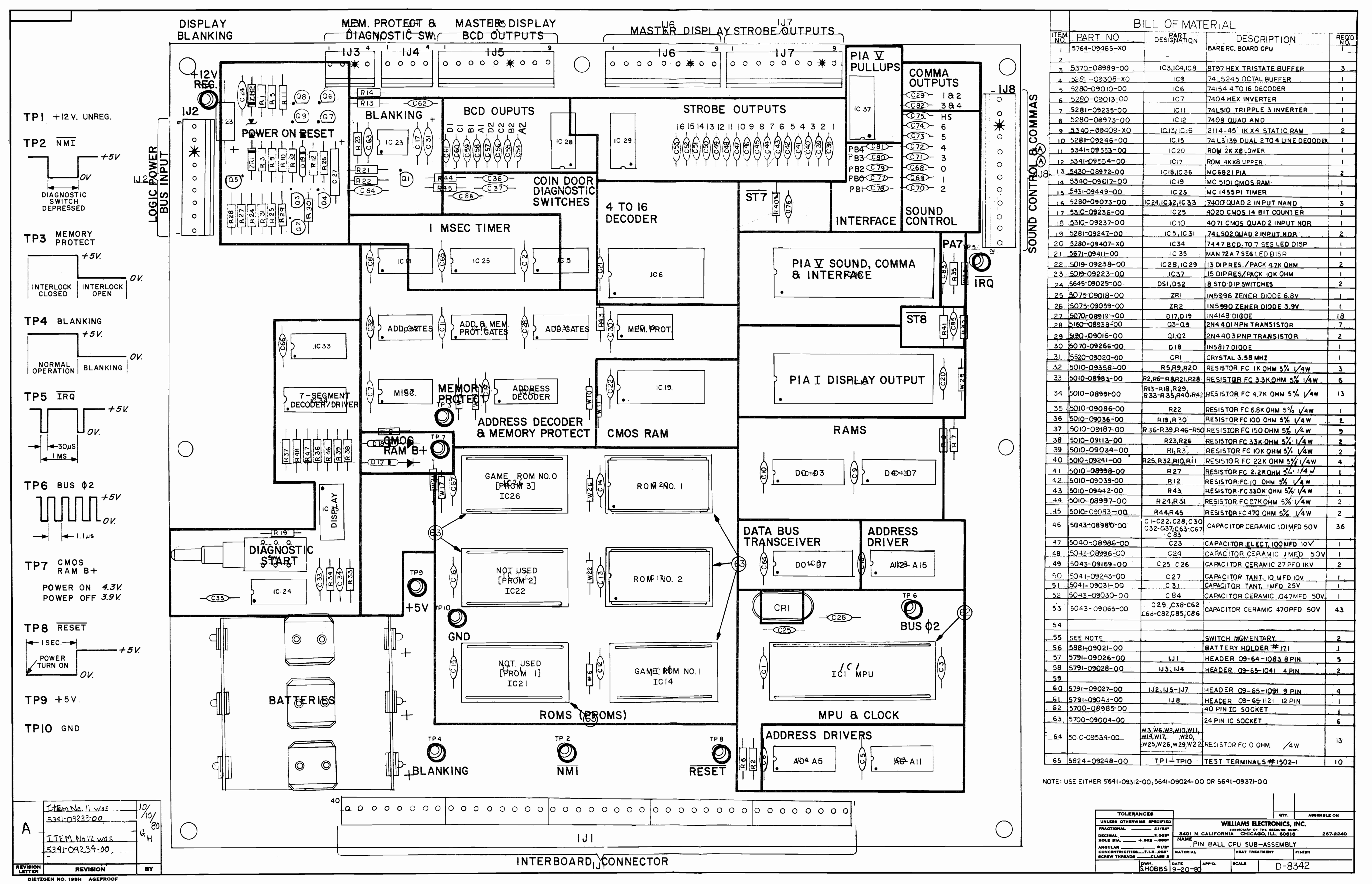
3. Turn on game using toggle switch located where power cord notch is cut.



NOTES:

1. CONNECTIONS ARE INDICATED BY CIRCLED NUMBERS AS FOLLOWS:
   - ① CPU BOARD
   - ② DRIVER BOARD
   - ③ POWER SUPPLY BOARD
   - ④ MASTER DISPLAY BOARD
   - ⑤ SLAVE DISPLAY BOARD
   - ⑥ CONTROL PANEL
   - ⑦ CABINET
   - ⑧ PLAYFIELD
   - ⑨ INSERT BOARD
   - ⑩ SOUND BOARD
   - ⑪ NOT ASSIGNED
2. REFER TO POWER WIRING DIAGRAM FOR CONNECTIONS TO 3P1.

Backbox Wiring Diagram



BILL OF MATERIAL

ITEM NO.	PART NO	PART DESIGNATION	DESCRIPTION	REQ'D NO.
1	5764-09465-X0		BARE P.C. BOARD CPU	1
2		–		
3	5370-08989-00	IC3, IC4, IC8	8T97 HEX TRISTATE BUFFER	3
4	5281-09308-X0	IC9	74LS245 OCTAL BUFFER	1
5	5280-09010-00	IC6	74154 4 TO 16 DECODER	1
6	5280-09013-00	IC7	7404 HEX INVERTER	1
7	5281-09235-00	IC11	74LS10 TRIPPLE 3 INVERTER	1
8	5280-08973-00	IC12	7408 QUAD AND	1
9	5340-09409-X0	IC13, IC16	2114-45 1K X4 STATIC RAM	2
10	5281-09246-00	IC15	74LS139 DUAL 2 TO 4 LINE DECODER	1
11	5341-09553-00	IC20	ROM 2K X8 LOWER	1
12	5341-09554-00	IC17	ROM 4KX8 UPPER	1
13	5430-08972-00	IC18, IC36	MC6821 PIA	2
14	5340-09017-00	IC19	MC 5101 CMOS RAM	1
15	5431-09449-00	IC23	MC 1455P1 TIMER	1
16	5280-09073-00	IC24, IC32, IC33	7400 QUAD 2 INPUT NAND	3
17	5310-09236-00	IC25	4020 CMOS 14 BIT COUNTER	1
18	5310-09237-00	IC10	4071 CMOS QUAD 2 INPUT NOR	1
19	5281-09247-00	IC5, IC31	74LS02 QUAD 2 INPUT NOR	2
20	5280-09407-X0	IC34	7447 BCD. TO 7 SEG LED DISP	1
21	5671-09411-00	IC35	MAN 72A 7 SEG LED DISP	1
22	5019-09238-00	IC28, IC29	13 DIP RES./PACK 4.7K OHM	2
23	5019-09223-00	IC37	15 DIP RES/PACK 10K OHM	1
24	5645-09025-00	DS1, DS2	8 STD DIP SWITCHES	2
25	5075-09018-00	ZR1	1N5996 ZENER DIODE 6.8V	1
26	5075-09059-00	ZR2	1N5990 ZENER DIODE 3.9V	1
27	5070-08919-00	D17, D19	1N4148 DIODE	18
28	5160-08938-00	Q3-Q9	2N4401 NPN TRANSISTOR	7
29	5190-09016-00	Q1, Q2	2N4403 PNP TRANSISTOR	2
30	5070-09266-00	D18	1N5817 DIODE	1
31	5520-09020-00	CR1	CRYSTAL 3.58 MHZ	1
32	5010-09358-00	R5, R9, R20	RESISTOR FC 1K OHM 5% 1/4W	3
33	5010-08983-00	R2, R6-R8, R21, R28	RESISTOR FC 3.3K OHM 5% 1/4W	6
34	5010-08991-00	R13-R18, R29, R33-R35, R40-R42	RESISTOR FC 4.7K OHM 5% 1/4W	13
35	5010-09086-00	R22	RESISTOR FC 6.8K OHM 5% 1/4W	1
36	5010-09036-00	R19, R30	RESISTOR FC 100 OHM 5% 1/4W	2
37	5010-09187-00	R36-R39, R46-R50	RESISTOR FC 150 OHM 5% 1/4W	9
38	5010-09113-00	R23, R26	RESISTOR FC 33K OHM 5% 1/4W	2
39	5010-09034-00	R1, R3	RESISTOR FC 10K OHM 5% 1/4W	2
40	5010-09241-00	R25, R32, R10, R11	RESISTOR FC 22K OHM 5% 1/4W	4
41	5010-08998-00	R27	RESISTOR FC 2.2K OHM 5% 1/4W	1
42	5010-09039-00	R12	RESISTOR FC 10 OHM 5% 1/4W	1
43	5010-09442-00	R43	RESISTOR FC 330K OHM 5% 1/4W	1
44	5010-08997-00	R24, R31	RESISTOR FC 27K OHM 5% 1/4W	2
45	5010-09083-00	R44, R45	RESISTOR FC 470 OHM 5% 1/4W	2
46	5043-08980-00	C1-C22, C28, C30, C32-C37, C63-C67, C83	CAPACITOR CERAMIC .01MFD 50V	36
47	5040-08986-00	C23	CAPACITOR ELECT. 100MFD 10V	1
48	5043-08996-00	C24	CAPACITOR CERAMIC .1MFD 50V	1
49	5043-09169-00	C25 C26	CAPACITOR CERAMIC 27 PFD 1KV	2
50	5041-09243-00	C27	CAPACITOR TANT. 10 MFD 10V	1
51	5041-09031-00	C31	CAPACITOR TANT. 1MFD 25V	1
52	5043-09030-00	C84	CAPACITOR CERAMIC .047MFD 50V	1
53	5043-09065-00	C29, C38-C62, C68-C82, C85, C86	CAPACITOR CERAMIC 470PFD 50V	43
54				
55	SEE NOTE		SWITCH MOMENTARY	2
56	5881-09021-00		BATTERY HOLDER #171	1
57	5791-09026-00	1J1	HEADER 09-64-1083 8 PIN	5
58	5791-09028-00	1J3, 1J4	HEADER 09-65-1041 4 PIN	2
59				
60	5791-09027-00	1J2, 1J5-1J7	HEADER 09-65-1091 9 PIN	4
61	5791-09043-00	1J8	HEADER 09-65-1121 12 PIN	1
62	5700-08985-00		40 PIN IC SOCKET	1
63	5700-09004-00		24 PIN IC SOCKET	6
64	5010-09534-00	W3, W6, W8, W10, W11, W14, W17, W20, W25, W26, W29, W22	RESISTOR FC 0 OHM 1/4W	13
65	5824-09248-00	TP1–TP10	TEST TERMINALS #1502-1	10

NOTE: USE EITHER 5641-09312-00, 5641-09024-00 OR 5641-09371-00

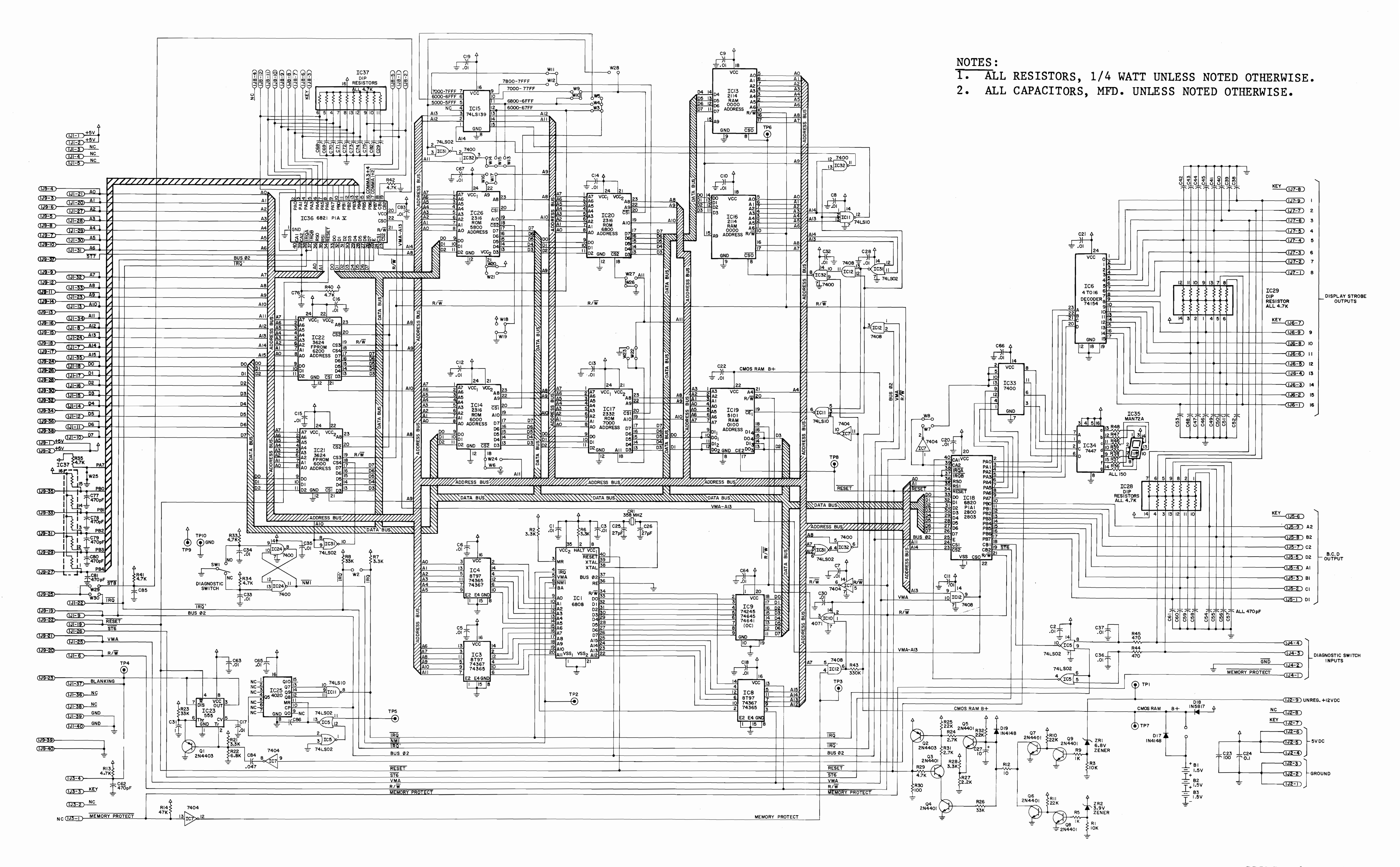
TOLERANCES UNLESS OTHERWISE SPECIFIED: FRACTIONAL ±1/64"; DECIMAL ±.005"; HOLE DIA. +.002 −.000"; ANGULAR ±1/2°; CONCENTRICITIES T.I.R. .003"; SCREW THREADS CLASS 2

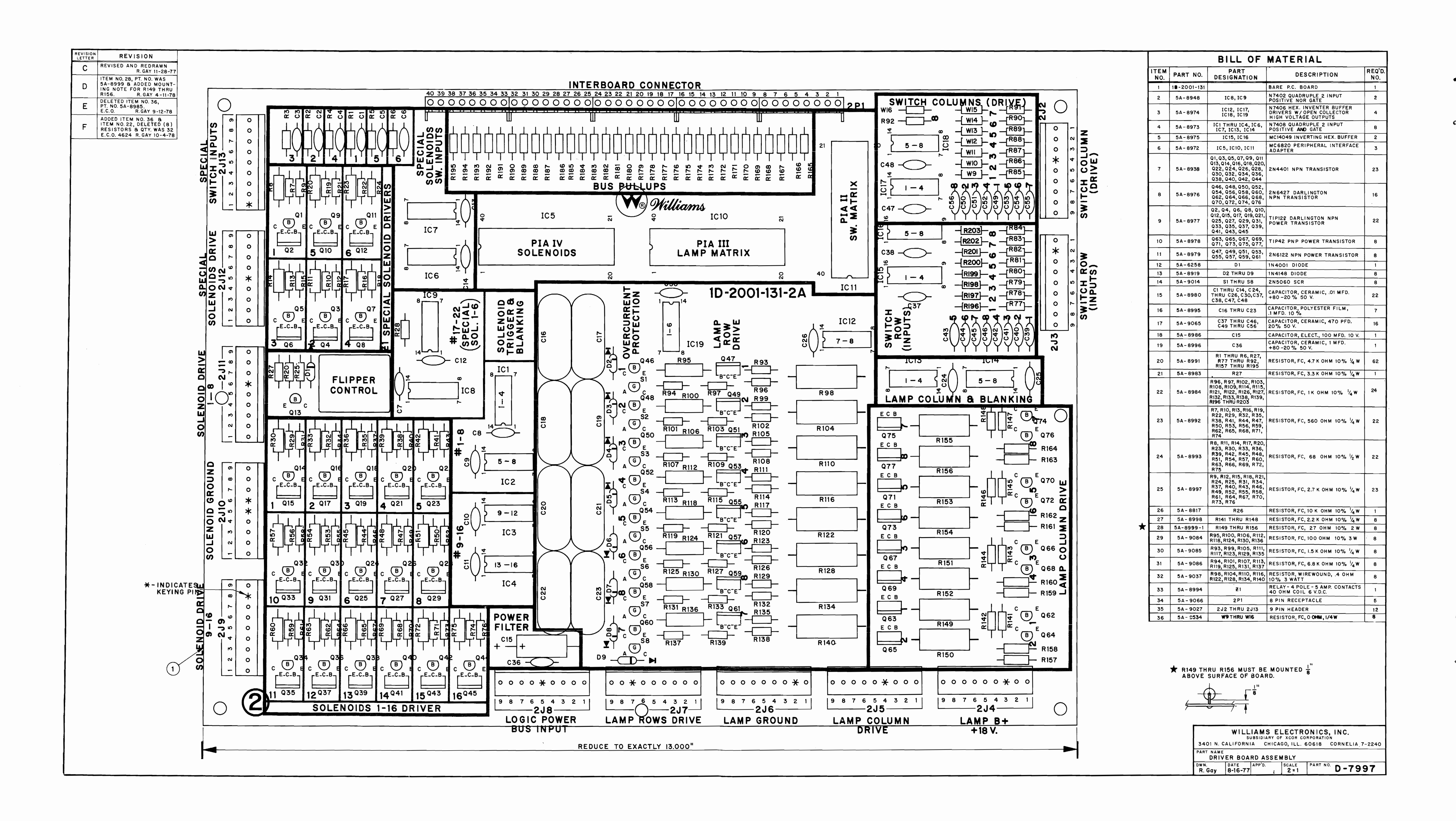
QTY. | ASSEMBLE ON

WILLIAMS ELECTRONICS, INC.
SUBSIDIARY OF THE SEEBURG CORP.
3401 N. CALIFORNIA CHICAGO, ILL. 60618 267-2240

NAME: PIN BALL CPU SUB-ASSEMBLY
MATERIAL | HEAT TREATMENT | FINISH
DWN. G. HOBBS | DATE 9-20-80 | APP'D. | SCALE | D-8342

CPU Board Assembly Drawing


NOTES:
1. ALL RESISTORS, 1/4 WATT UNLESS NOTED OTHERWISE.
2. ALL CAPACITORS, MFD. UNLESS NOTED OTHERWISE.
IC36 6821 PIA V
IC37 DIP RESISTORS ALL 4.7K
IC15 74LS139
IC26 2316 ROM 5800 ADDRESS
IC20 2316 ROM 6800 ADDRESS
IC13 2114 RAM 0000 ADDRESS
IC16 2114 RAM 0000 ADDRESS
IC22 3624 FPROM 6200 ADDRESS
IC14 2316 ROM 6000 ADDRESS
IC17 2332 ROM 7000 ADDRESS
IC19 5101 RAM 0100 ADDRESS
IC21 3624 FPROM 6000 ADDRESS
IC6 4 TO 16 DECODER 74154
IC29 DIP RESISTOR ALL 4.7K
DISPLAY STROBE OUTPUTS
IC33 7400
IC34 7447
IC35 MAN72A
IC28 DIP RESISTORS ALL 4.7K
IC18 6820 PIA I 2800 2803
B.C.D OUTPUT
IC4 8T97 74365 74367
IC3 8T97 74367 74365
IC1 6808
IC9 74245 74645 74641 (OC)
IC8 8T97 74367 74365
IC23 555
IC25 4020
DIAGNOSTIC SWITCH
DIAGNOSTIC SWITCH INPUTS
MEMORY PROTECT
CMOS RAM B+
5VDC
GROUND
ADDRESS BUS
DATA BUS



REVISION LETTER	REVISION
C	REVISED AND REDRAWN R. GAY 11-28-77
D	ITEM NO. 28, PT. NO. WAS 5A-8999 & ADDED MOUNTING NOTE FOR R149 THRU R156. R. GAY 4-11-78
E	DELETED ITEM NO. 36, PT. NO. 5A-8985. E.C.O. R. GAY 9-12-78
F	ADDED ITEM NO. 36 & ITEM NO. 22, DELETED (8) RESISTORS & QTY. WAS 32 E.C.O. 4624 R. GAY 10-4-78

BILL OF MATERIAL

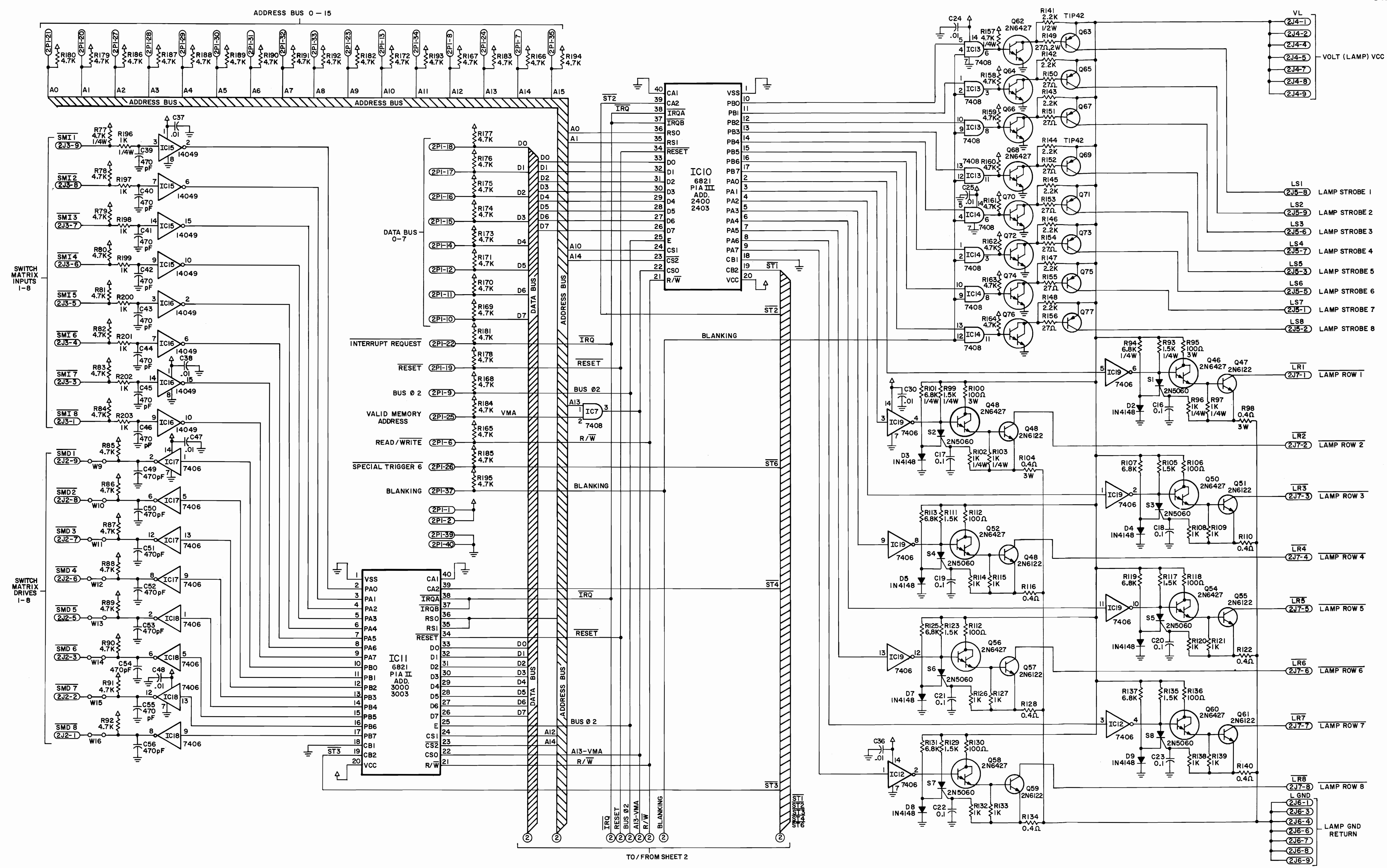
ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D. NO.
1	1B-2001-131		BARE P.C. BOARD	1
2	5A-8948	IC8, IC9	N7402 QUADRUPLE 2 INPUT POSITIVE NOR GATE	2
3	5A-8974	IC12, IC17, IC18, IC19	N7406 HEX. INVENTER BUFFER DRIVERS W/OPEN COLLECTOR HIGH VOLTAGE OUTPUTS	4
4	5A-8973	IC1 THRU IC4, IC6, IC7, IC13, IC14	N7408 QUADRUPLE 2 INPUT POSITIVE AND GATE	8
5	5A-8975	IC15, IC16	MC14049 INVERTING HEX. BUFFER	2
6	5A-8972	IC5, IC10, IC11	MC6820 PERIPHERAL INTERFACE ADAPTER	3
7	5A-8938	Q1, Q3, Q5, Q7, Q9, Q11 Q13, Q14, Q16, Q18, Q20, Q22, Q24, Q26, Q28, Q30, Q32, Q34, Q36, Q38, Q40, Q42, Q44	2N4401 NPN TRANSISTOR	23
8	5A-8976	Q46, Q48, Q50, Q52, Q54, Q56, Q58, Q60, Q62, Q64, Q66, Q68, Q70, Q72, Q74, Q76	2N6427 DARLINGTON NPN TRANSISTOR	16
9	5A-8977	Q2, Q4, Q6, Q8, Q10, Q12, Q15, Q17, Q19, Q21, Q25, Q27, Q29, Q31, Q33, Q35, Q37, Q39, Q41, Q43, Q45	TIP122 DARLINGTON NPN POWER TRANSISTOR	22
10	5A-8978	Q63, Q65, Q67, Q69, Q71, Q73, Q75, Q77,	TIP42 PNP POWER TRANSISTOR	8
11	5A-8979	Q47, Q49, Q51, Q53, Q55, Q57, Q59, Q61	2N6122 NPN POWER TRANSISTOR	8
12	5A-6258	D1	1N4001 DIODE	1
13	5A-8919	D2 THRU D9	1N4148 DIODE	8
14	5A-9014	S1 THRU S8	2N5060 SCR	8
15	5A-8980	C1 THRU C14, C24, THRU C26, C30, C37, C38, C47, C48	CAPACITOR, CERAMIC, .01 MFD. +80 -20 % 50 V.	22
16	5A-8995	C16 THRU C23	CAPACITOR, POLYESTER FILM, .1 MFD. 10 %	7
17	5A-9065	C37 THRU C46, C49 THRU C56	CAPACITOR, CERAMIC, 470 PFD. 20% 50 V.	16
18	5A-8986	C15	CAPACITOR, ELECT., 100 MFD. 10 V.	1
19	5A-8996	C36	CAPACITOR, CERAMIC, 1 MFD. +80 -20 % 50 V.	1
20	5A-8991	R1 THRU R6, R27, R77 THRU R92, R157 THRU R195	RESISTOR, FC, 4.7 K OHM 10% 1/4 W	62
21	5A-8983	R27	RESISTOR, FC, 3.3 K OHM 10% 1/4 W	1
22	5A-8984	R96, R97, R102, R103, R108, R109, R114, R115, R121, R122, R126, R127, R132, R133, R138, R139, R196 THRU R203	RESISTOR, FC, 1K OHM 10% 1/4 W	24
23	5A-8992	R7, R10, R13, R16, R19, R22, R29, R32, R35, R38, R41, R44, R47, R50, R53, R56, R59, R62, R65, R68, R71, R74	RESISTOR, FC, 560 OHM 10% 1/4 W	22
24	5A-8993	R8, R11, R14, R17, R20, R23, R30, R33, R36, R39, R42, R45, R48, R51, R54, R57, R60, R63, R66, R69, R72, R75	RESISTOR, FC, 68 OHM 10% 1/2 W	22
25	5A-8997	R9, R12, R15, R18, R21, R24, R25, R31, R34, R37, R40, R43, R46, R49, R52, R55, R58, R61, R64, R67, R70, R73, R76	RESISTOR, FC, 2.7 K OHM 10% 1/4 W	23
26	5A-8817	R26	RESISTOR, FC, 10 K OHM 10% 1/4 W	1
27	5A-8998	R141 THRU R148	RESISTOR, FC, 2.2 K OHM 10% 1/4 W	8
★ 28	5A-8999-1	R149 THRU R156	RESISTOR, FC, 27 OHM 10% 2 W	8
29	5A-9084	R95, R100, R106, R112, R118, R124, R130, R136	RESISTOR, FC, 100 OHM 10% 3 W	8
30	5A-9085	R93, R99, R105, R111, R117, R123, R129, R135	RESISTOR, FC, 1.5 K OHM 10% 1/4 W	8
31	5A-9086	R94, R101, R107, R113, R119, R125, R131, R137	RESISTOR, FC, 6.8 K OHM 10% 1/4 W	8
32	5A-9037	R98, R104, R110, R116, R122, R128, R134, R140	RESISTOR, WIREWOUND, .4 OHM 10% 3 WATT	8
33	5A-8994	Z1	RELAY - 4 POLE - 5 AMP. CONTACTS 40 OHM COIL 6 V.D.C.	1
34	5A-9066	2P1	8 PIN RECEPTACLE	5
35	5A-9027	2J2 THRU 2J13	9 PIN HEADER	12
36	5A-9534	W9 THRU W16	RESISTOR, FC, 0 OHM, 1/4W	8

★ R149 THRU R156 MUST BE MOUNTED 1/8" ABOVE SURFACE OF BOARD.

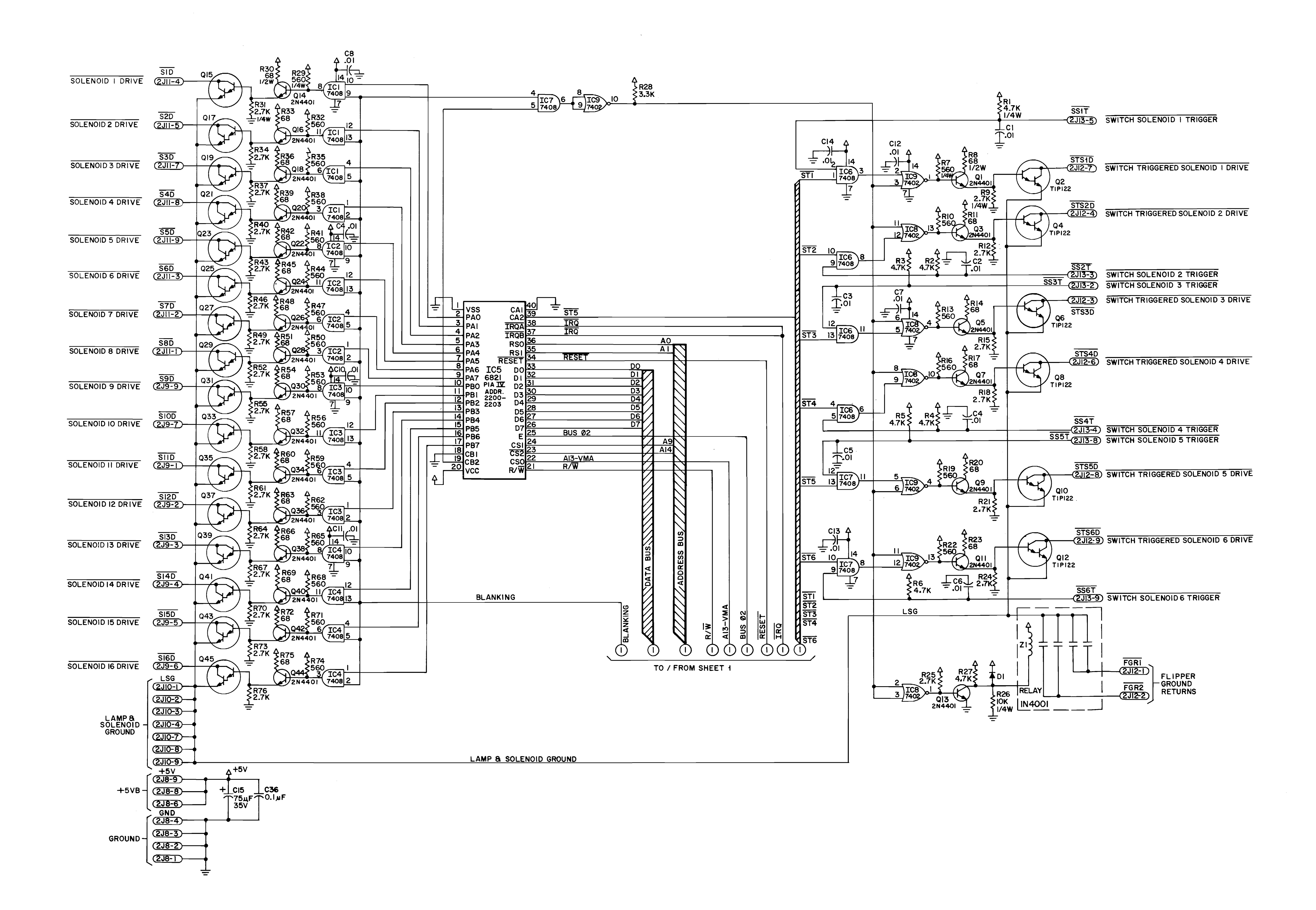
WILLIAMS ELECTRONICS, INC.
SUBSIDIARY OF XCOR CORPORATION
3401 N. CALIFORNIA CHICAGO, ILL. 60618 CORNELIA 7-2240

PART NAME				
DRIVER BOARD ASSEMBLY				
DWN. R. Gay	DATE 8-16-77	APP'D.	SCALE 2=1	PART NO. D-7997

Driver Board Assembly Drawing



Driver Board Logic Diagram (Sheet 1 of 2)

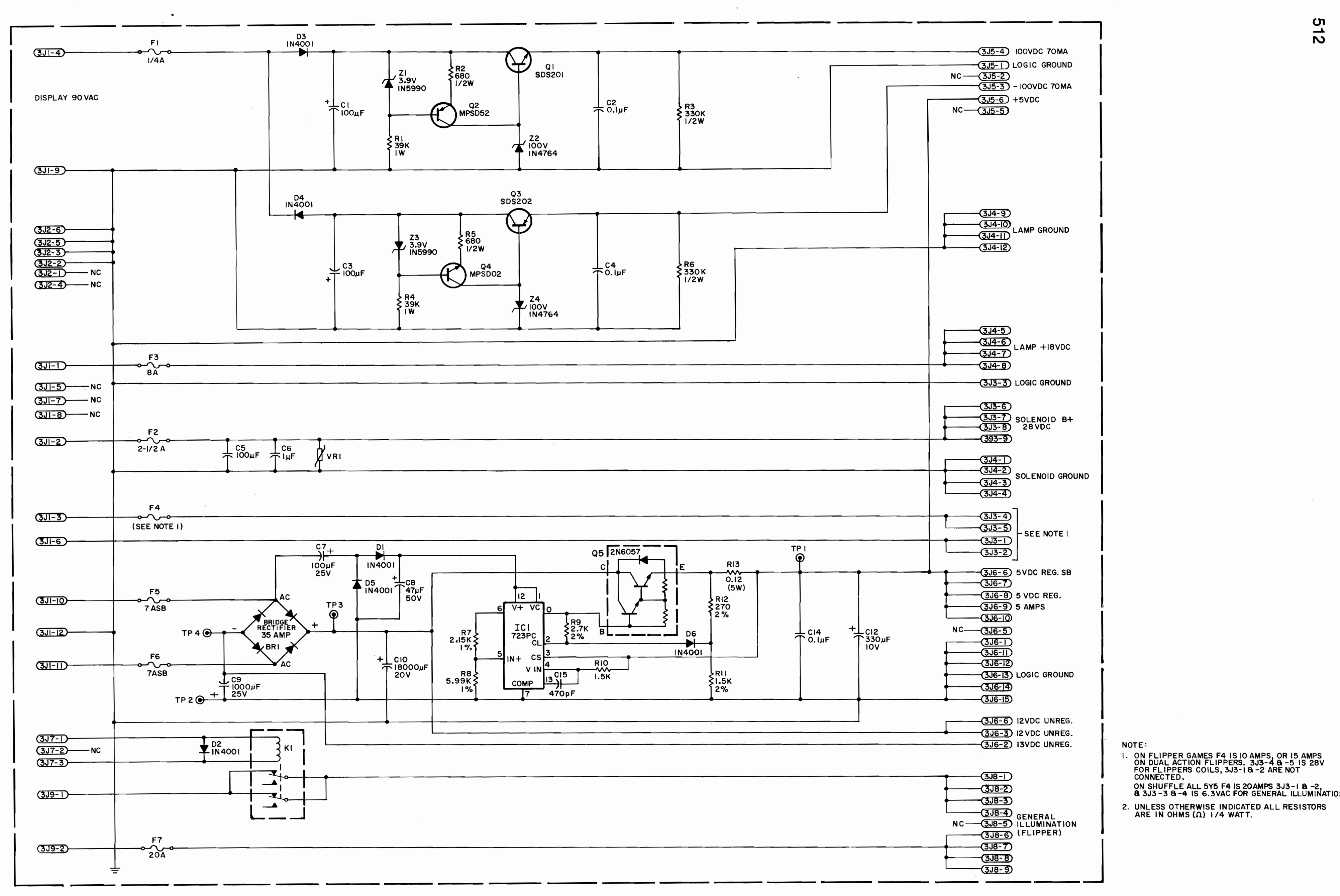


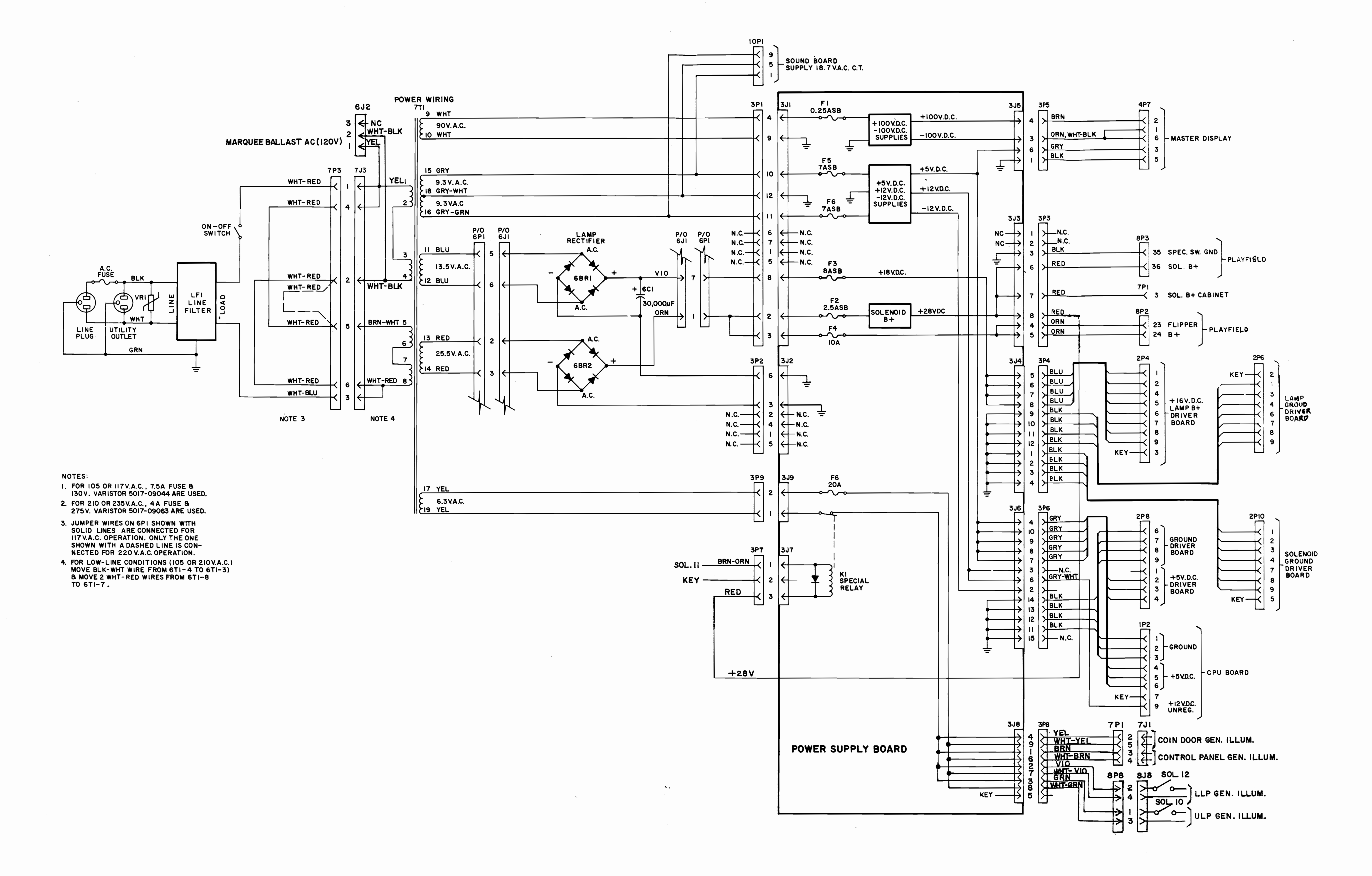
Driver Board Logic Diagram (Sheet 2 of 2)

BILL OF MATERIAL

ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D NO.
1	5765-09466		BARE P.C. BOARD	1
2	5013-09426	R7	RESISTOR, 2.15K, 1%, 1/4 W, METAL FILM	1
3	5013-09427	R8	RESISTOR, 4.99K, 1%, 1/4 W, METAL FILM	1
4	5010-09428	R11	RESISTOR, 1.5K, 2%, 1/4 W, CARBON FILM	1
5	5010-09085	R10	RESISTOR, 2.7K, 2%, 1/4 W	1
6	5010-09541	R9	RESISTOR, 2.7K, 2%, 1/4 W	1
7	5010-09508	R12	RESISTOR, 270 OHM, 2% 1/4 W, CARBON FILM	1
8	5012-09429	R13	POWER RESISTOR, 0.12 OHM, 5%, 5W	1
9	5010-09536	R1, R4	RESISTOR, 39K, 5%, 1 W	2
10	5010-09061	R2, R5	RESISTOR, 680 OHM, 2 W	2
11	5010-09069	R3, R6	RESISTOR, 330K, 5%, 1/2 W	2
12	5040-09419	C10	CAP.,ELECTROLYTIC, 18,000 MFD, 20V, AXIAL	1
13	5040-09420 5040-08893	C9	CAP.,ELECTROLYTIC 1,000 MFD 25V, RADIAL OR AXIAL	1
14	5040-09423	C12	CAP.,ELECTROLYTIC 330 MFD, 10V, RADIAL	1
15	5043-09065	C15	CAPACITOR, 470 pFD	1
16	5040-09053	C1, C3	CAPACITOR, 100 MFD,ELECT.,150V	2
17	5040-09070 5043-09537	C5	CAPACITOR, 100 MFD, ELECT., 100V, AXIAL OR RADIAL	1
18	5070-09446	C14	CAPACITOR, 0.1 MFD, 50V, DISC.	1
19	5070-06258	D1,D2,D3,D4,D5,D6	DIODE, IN4001	6
20	5075-09059	ZR1, ZR3	ZENER, IN5990, 3.9V, 5%	2
21	5075-09060	ZR2, ZR4	ZENER, IN4764, 100V, 5%	2
22	5060-09424	IC1	VOLTAGE REGULATOR, MC1723 PC	1
23	5043-09443	C2,C4,C6	CAPACITOR, 0.1 MFD, 200V, DISC	3
24	5040-09421	C7	CAPACITOR, 100 MFD, 25V, RADIAL	1
25	5164-09057	Q1	TRANSISTOR, SDS 201 NPN	1
26	5164-09056	Q4	TRANSISTOR, MPS D02 NPN	1
27	5194-09058	Q3	TRANSISTOR, SDS 202 PNP	1
28	5194-09055	Q2	TRANSISTOR, MPS D52 PNP	1
29	5705-04431		HEAT SINK	
30	5791-09067	3J5	CONNECTOR, 6 PIN (H)	1
31	5791-09074	3J6	CONNECTOR, 15 PIN (H)	1
32	5791-09027	3J8, 3J3	CONNECTOR, 9 PIN (H)	2
33	5791-09038	3J2	CONNECTOR, 6 PIN (H)	1
34	5162-09425	Q5	TRANSISTOR, POWER, 2N6087 NPN	
35	5791-09043	3J4	CONNECTOR, 12 PIN (H)	1
36	5791-09435	3J7	CONNECTOR, 3 PIN (H)	1
37	5791-09436	3J9	CONNECTOR, 2 PIN (H)	1
38	5791-09068	3J1	CONNECTOR, 12 PIN	1
39	5732-09178		FUSE HOLDER	14
40	5731-09128	F2	FUSE, 2-1/2 AMP, S.B.	1
41	5730-09071	F3	FUSE, 8 AMP	
42	5730-06508 5730-06567	F4	FUSE, 10 AMP, OR, FUSE, 15 AMP	1
43	5730-09127	F7	FUSE, 20 AMP	1
44	5731-08761	F1	FUSE, 20 AMP	1
45	5017-09061	VR1	VARISTOR	1
47A	5700-09445		SOCKET	
47B	5701-09538		MICA INSULATOR	
47	5580-09555	K1	RELAY, 24 VDC, 10 AMP, DPDT	1
48	5824-09248		TERMINAL, #1502-1 (TEST POST)	3
49	5100-09418	BR-1	BRIDGE RECTIFIER, 35 AMP, 100V	1
50	5705-09042		HEAT SINK	2
51	3A-7520-1		TIE WRAP	1
52	4005-01016-07		5-40 x 7/16 R.H. MECH. SCREW	2
53	4405-01117		5-40 HEX NUT	2
54		W1, W2	JUMPER, #18 AWG	2
55	5040-09422	C8	CAPACITOR, 47 MFD, 50V, RADIAL	1
56	20-9229		THERMAL COMPOUND	
57			LEAD WIRE, #18 AWG (3")	3
58	5731-09432	F6, F5	FUSE, 7A, S.B., 250V	2

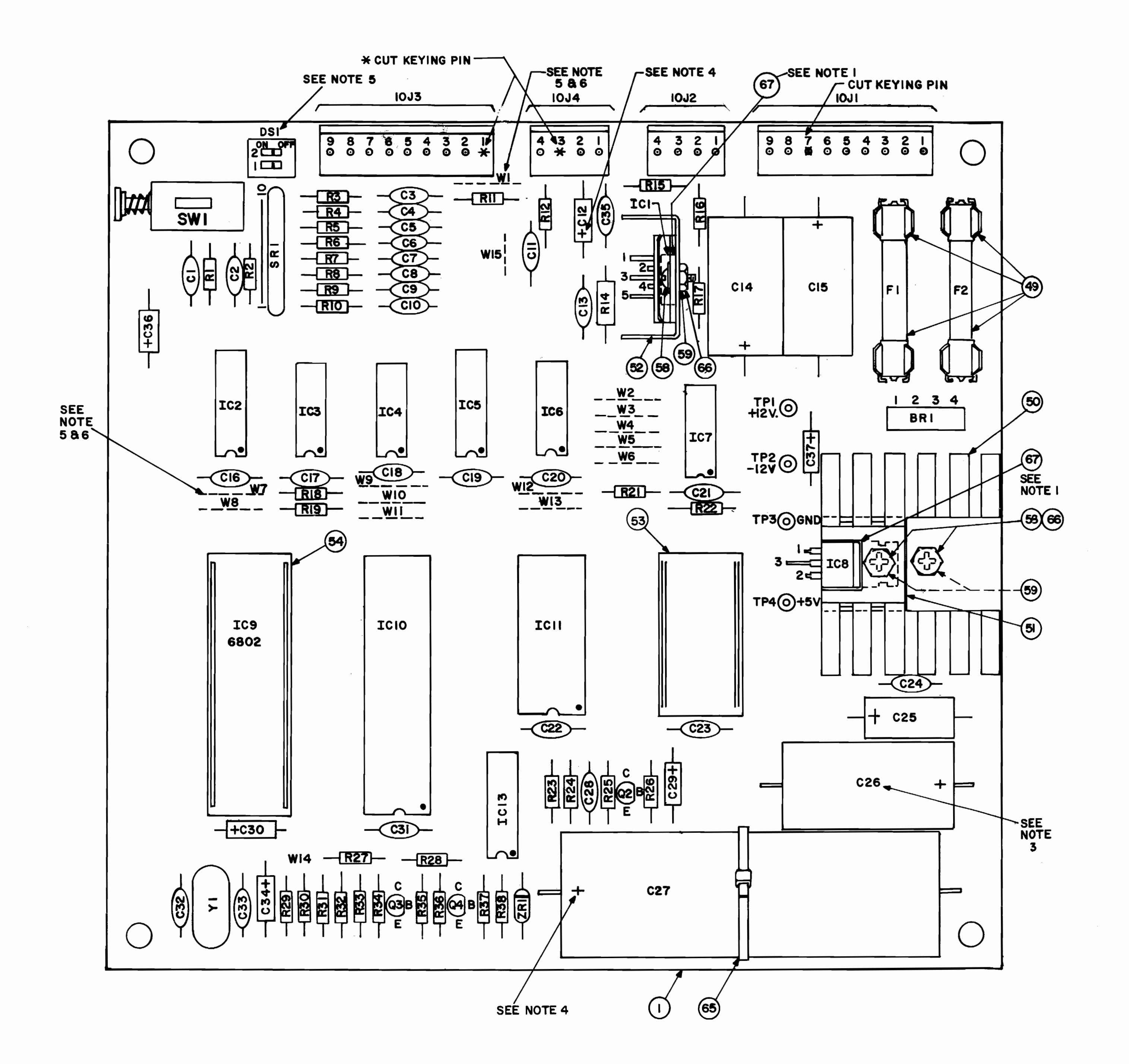
NOTES:
1. HEAT SINK COMPOUND MUST BE APPLIED BETWEEN TRANSISTOR AND HEAT SINK.
2. FOR BLACKOUT AND FUTURE GAME WITH SAME FEATURE REMOVE JUMPERS (W1 & W2) AND INSERT RELAY K1, DIODE D2 AND 3J7.
3. ON FLIPPER GAMES F4 IS 10 AMPS OR (DUAL ACTION FLIPPERS) 15 AMPS ON SHUFFLE ALLEYS F4 IS 20 AMPS.
4. OBSERVE INDEX MARK OF INTEGRATED CIRCUIT, POLARITY OF CAPACITORS, DIODE AND POSITION OF TRANSISTORS.
5. REFERENCE DWG'S: SCHEMATIC 16-8786.





NOTES:

1. FOR 105 OR 117V.A.C., 7.5A FUSE & 130V. VARISTOR 5017-09044 ARE USED.
2. FOR 210 OR 235V.A.C., 4A FUSE & 275V. VARISTOR 5017-09063 ARE USED.
3. JUMPER WIRES ON 6P1 SHOWN WITH SOLID LINES ARE CONNECTED FOR 117V.A.C. OPERATION. ONLY THE ONE SHOWN WITH A DASHED LINE IS CONNECTED FOR 220V.A.C. OPERATION.
4. FOR LOW-LINE CONDITIONS (105 OR 210V.A.C.) MOVE BLK-WHT WIRE FROM 6T1-4 TO 6T1-3) & MOVE 2 WHT-RED WIRES FROM 6T1-8 TO 6T1-7.



BILL OF MATERIAL

ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D. NO.
1	01-2 01-146-6		BARE P.C. BOARD REV F	1
2	5370-09156-00	IC1	TDA 2002 V AUDIO AMPLIFIER	1
3	5280-09012-00	IC2	7442 BCD-DEC DECODER	1
4	5280-09073-00	IC3	7400 QUAD 2 INPUT NAND	1
5	5280-08973	IC4	7408 QUAD 2 INP. AND GATE	1
6	5310-09153-00	IC5	4050 BUFFER	1
7	5310-09154-00	IC6	4068 8 INPUT NAND GATE	1
8	5310-08971-00	IC7	4069 HEX INVERTER	1
9	5250-09157-00	IC8	7805 5 VOLT REG. W/TO 220 CASE	1
10	5430-08972-00	IC10	6821 P.I.A.	1
11	5340-09003-00	IC11	6810 RAM	1
12	5371-09152-00	IC13	1408 D/A CONVERTER	1
13	5160-08938-00	Q2, Q3, Q4	2N4401 NPN TRANSISTOR	3
14				
15	5075-09018-00	ZR1	IN5996A 6.8V ZENER DIODE	1
16				
17	5100-09357-00)	BR1	MDA 200/3N253	1
	5100-09158-00)		BRIDGE RECTIFIER	0
18	5520-09020-00	Y1	3.58 MHz CRYSTAL	1
19	5010-08991-00	R1,R18,R19,R21,R22, R27,R30,R31, R32	RESISTOR, FC, 4.7K OHM, 5% 1/4 WATT	9
20	5010-09036-00	R2 thru R10	RESISTOR, FC, 100 OHM, 5% 1/4W	9
21	5010-09358-00	R12,R15,R28,R36,R38	RESISTOR, FC, 1K OHM, 5% 1/4W	5
22	5010-09181-00	R14	RESISTOR, FC, 1 OHM, 10% 1/2 WATT	1
23	5010-09161-00	R16	RESISTOR, FC, 2.2 OHM, 5% 1/4 WATT	1
24	5010-09361-00	R17	RESISTOR, FC, 220 OHM, 5% 1/2 WATT	1
25				
26	5010-08983-00	R23, R24, R26	RESISTOR, FC, 3.3K OHM, 5% 1/4 WATT	3
27	5010-09179-00	R25	RESISTOR, FC, 3.3M OHM, 5% 1/4 WATT	1
28	5010-09035-00	R29	RESISTOR, FC, 47K OHM, 5% 1/4 WATT	1
29	5010-09034-00	R33, R35, R37	RESISTOR, FC, 10K OHM, 5% 1/4 WATT	3
30	5010-09039-00	R34	RESISTOR, FC, 10 OHM, 5% 1/4 WATT	1
31	5043-08980-00	C1, C16 thru C23, C31	CAPACITOR, CER. .01 MFD. 50V. +80%, -20%	10
32	5043-09065-00	C2 thru C10	CAPACITOR, CER. 470 PFD. 50V. +-20%	9
33	5043-09345-00	C11	CAPACITOR, CER. .001 MFD. +-20% 100V.	1
34	5040-09365-00	C12, C30, C36	CAPACITOR, ELECT. 1 MFD. 63V. -10 +50%	3
35	5043-08996-00	C13, C24, C35	CAPACITOR, CER. .1 MFD. 50V. +-20%	3
36	5040-09165-00	C14	CAPACITOR, ELECT. 1,000 MFD. 16V. +-20%	1
37	5040-09164-00	C15	CAPACITOR, ELECT. 470 MFD. 10V. +-20%	1
38	5040-08986-00	C25	CAPACITOR, ELECT. 100 MFD. 10V. +-20%	1
39	5040-08893-00	C26	CAPACITOR, ELECT. 1,000 MFD. 25V. +-20%	1
40	5040-09376-00	C27	CAPACITOR, ELECT. 4700 MFD. 16V. +-20%	1
41	5043-09180-00	C28	CAPACITOR, CER. 47 PFD. 1K V. +-20%	1
42	5040-09343-00)	C29	CAPACITOR, ELECT. 10 MFD. 20V	1
43	5043-09169-00	C32, C33	CAPACITOR, CER. DISC, 27 PFD. 1KV. +-10%	2
44	5041-09163-00	C34	CAPACITOR, TANTALUM 2.2 MFD. 15V. +-20%	1
45	5041-09031-00	C37	CAPACITOR, TANTALUM 1 MFD. 25V. +-20%	1
46	5641-09658-00)	SW1	MOMENTARY SWITCH SPDT	1
47	5645-09330-00	DS1	2 STD, DIP SWITCH	1
48	5731-06314-00	F1, F2	4 AMP SLOW BLOW FUSE	2
49	5732-09178-00		FUSEHOLDER	4
50	5705-09172-00		HEAT SINK THERMALLOY #6072B	1
51	5705-09173-00		HEAT SINK THERMALLOY #6071B	1
52	5705-09199-00		HEAT SINK THERMALLOY #6030	1
53	5700-09004-00		24 PIN SOCKET	1
54	5700-08985-00		40 PIN SOCKET	1
55	5791-09027-00	10J1, 10J3	9 PIN MALE CONNECTOR 09-65-1091	2
56	5791-09028-00	10J2, 10J4	4 PIN MALE CONNECTOR 09-65-1041	2
57				
58	4006-01003-06		6-32x3/8" P-PH-S	3
59	4406-01117-00		6-32 HEX NUT	3
60	5010-09534-00		0 OHM RESISTOR	A/R
61	5824-09248-00	TP1 THR TP4	TERMINAL #1502-1	4
62	5010-09363-00	R11	RESISTOR, FC, 5.6K OHM 5% 1/4 WATT	1
63				
64	5019-09362-00	SR1	RESISTOR, 4.7K OHM 10 PIN SIP	1
65	03-7520-1		TIE WRAP	1
66	4703-00007-00		#6 EXT. LOCKWASHER	3
67	20-9229		THERMAL COMPOUND	.01

NOTES:

1. USE THERMAL COMPOUND BETWEEN IC1 AND IC8, AND HEAT SINKS.
2. CAUTION: AVOID STATIC DISCHARGE DAMAGE TO MOS LOGIC.
3. SYMBOLS SHOWN ON COMPONENTS ARE FOR REFERENCE ONLY. DO NOT SCREEN OR STAMP.
4. OBSERVE INDEX MARK OF ALL INTEGRATED CIRCUITS;

   DIODES D1, D2, AND ZR1;

   CAPACITORS C12, C14, C15, C25, C26, C27;

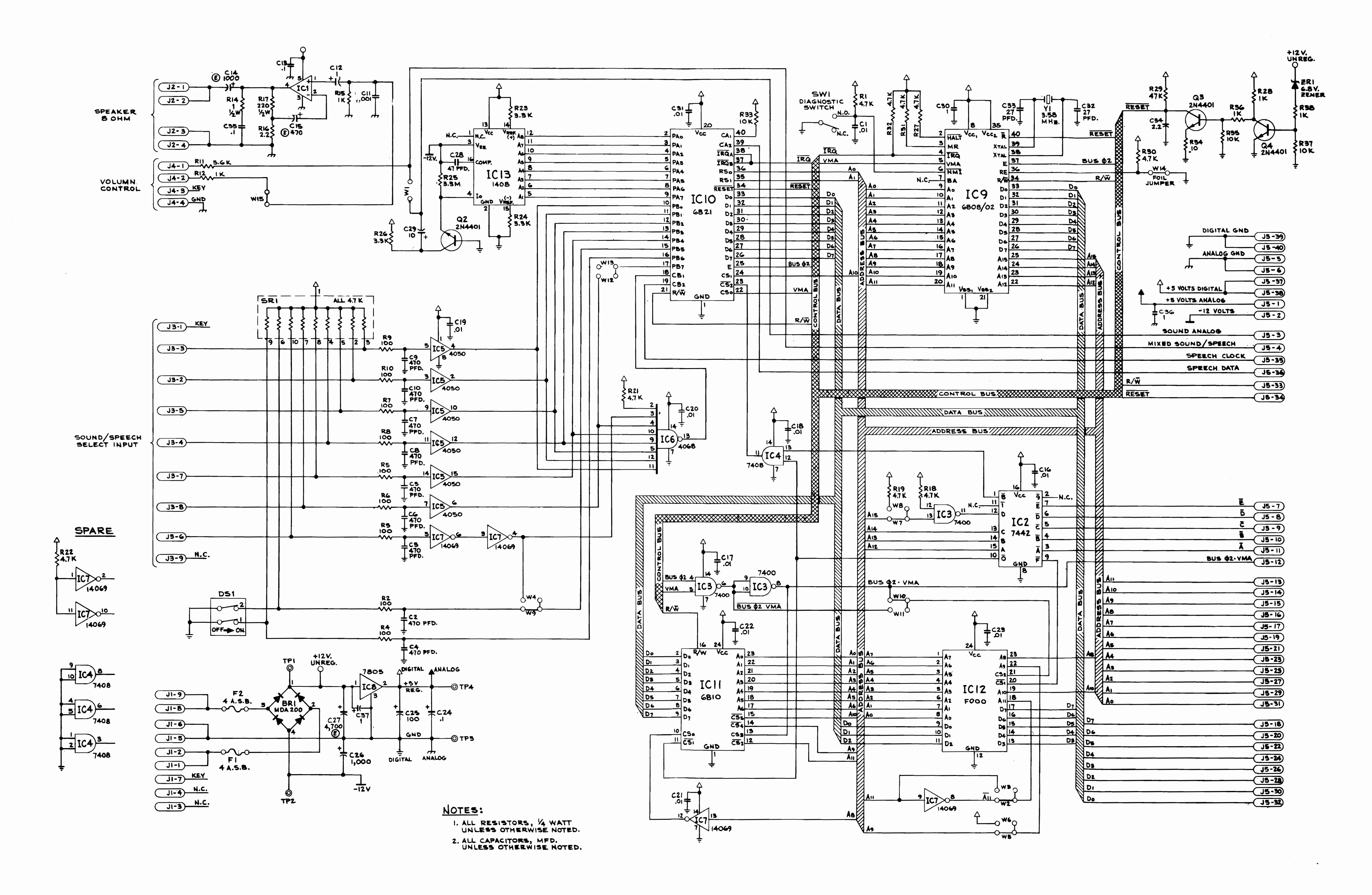
   CONNECTORS 10J1, 10J2, 10J4, 10J3, 10J5;

   POSITION OF TRANSISTORS Q1, Q2, Q3, Q4.
5. JUMPERS

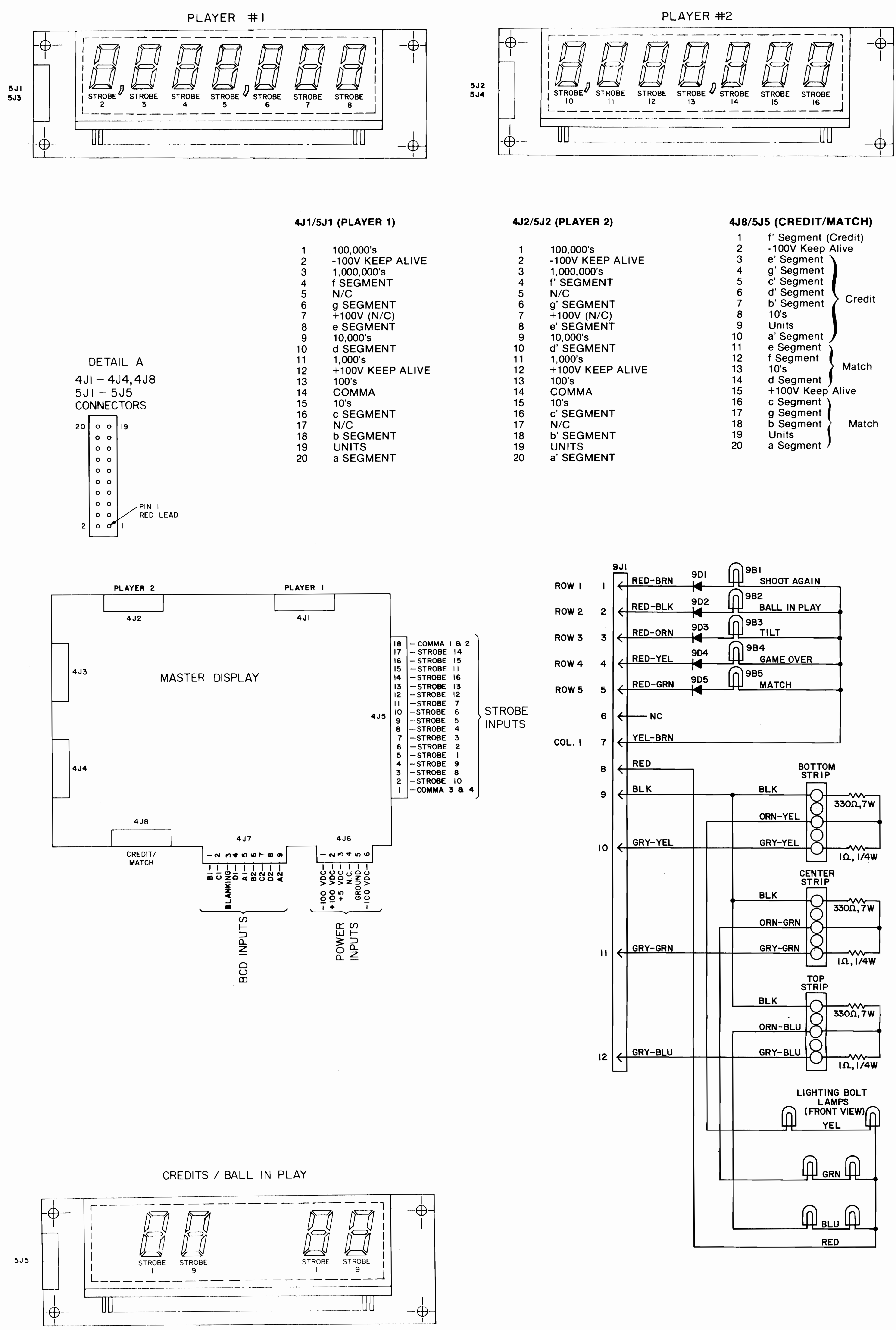
   W2), W5), W9), W10) IN

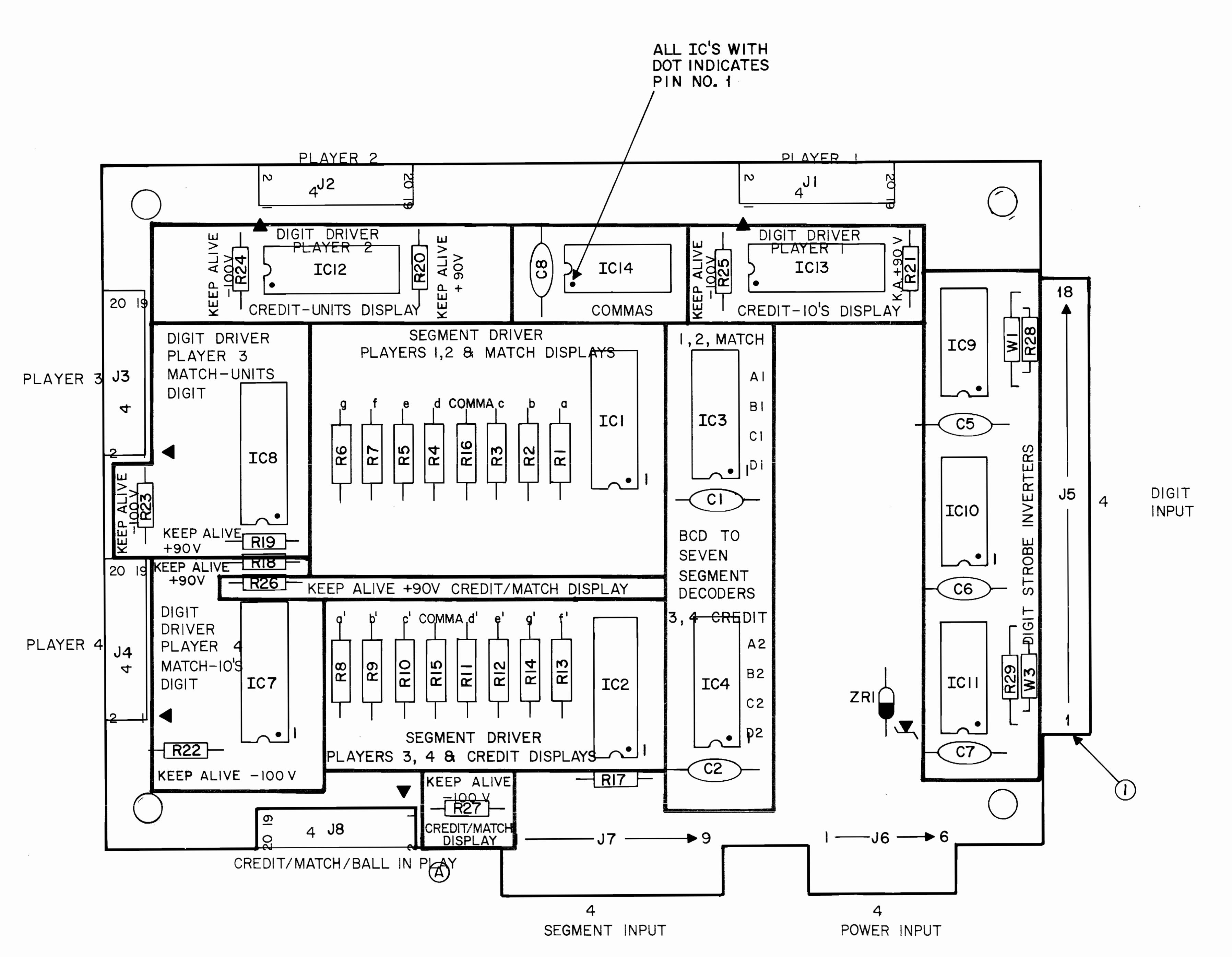
   W3), W4), W6), W11), W12), W13) OUT

Sound Board Assembly Drawing



Sound Board Logic Diagram


PLAYER #1
STROBE 2
STROBE 3
STROBE 4
STROBE 5
STROBE 6
STROBE 7
STROBE 8
5J1
5J3
PLAYER #2
STROBE 10
STROBE 11
STROBE 12
STROBE 13
STROBE 14
STROBE 15
STROBE 16
5J2
5J4
4J1/5J1 (PLAYER 1)
1 100,000's
2 -100V KEEP ALIVE
3 1,000,000's
4 f SEGMENT
5 N/C
6 g SEGMENT
7 +100V (N/C)
8 e SEGMENT
9 10,000's
10 d SEGMENT
11 1,000's
12 +100V KEEP ALIVE
13 100's
14 COMMA
15 10's
16 c SEGMENT
17 N/C
18 b SEGMENT
19 UNITS
20 a SEGMENT
4J2/5J2 (PLAYER 2)
1 100,000's
2 -100V KEEP ALIVE
3 1,000,000's
4 f' SEGMENT
5 N/C
6 g' SEGMENT
7 +100V (N/C)
8 e' SEGMENT
9 10,000's
10 d' SEGMENT
11 1,000's
12 +100V KEEP ALIVE
13 100's
14 COMMA
15 10's
16 c' SEGMENT
17 N/C
18 b' SEGMENT
19 UNITS
20 a' SEGMENT
4J8/5J5 (CREDIT/MATCH)
1 f' Segment (Credit)
2 -100V Keep Alive
3 e' Segment
4 g' Segment
5 c' Segment
6 d' Segment
7 b' Segment
8 10's
9 Units
10 a' Segment
11 e Segment
12 f Segment
13 10's
14 d Segment
15 +100V Keep Alive
16 c Segment
17 g Segment
18 b Segment
19 Units
20 a Segment
Credit
Match
Match
DETAIL A
4J1 – 4J4, 4J8
5J1 – 5J5
CONNECTORS
PIN 1
RED LEAD
MASTER DISPLAY
PLAYER 2
4J2
PLAYER 1
4J1
4J3
4J4
4J5
STROBE INPUTS
COMMA 1 & 2
STROBE 14
STROBE 15
STROBE 11
STROBE 16
STROBE 13
STROBE 12
STROBE 7
STROBE 6
STROBE 5
STROBE 4
STROBE 3
STROBE 2
STROBE 1
STROBE 9
STROBE 8
STROBE 10
COMMA 3 & 4
4J8
CREDIT/MATCH
4J7
BCD INPUTS
A2
D2
C2
B2
A1
D1
BLANKING
C1
B1
4J6
POWER INPUTS
-100 VDC
GROUND
N.C.
+5 VDC
+100 VDC
-100 VDC
9J1
ROW 1
ROW 2
ROW 3
ROW 4
ROW 5
COL. 1
RED-BRN
RED-BLK
RED-ORN
RED-YEL
RED-GRN
NC
YEL-BRN
RED
BLK
GRY-YEL
GRY-GRN
GRY-BLU
9D1
9D2
9D3
9D4
9D5
9B1 SHOOT AGAIN
9B2 BALL IN PLAY
9B3 TILT
9B4 GAME OVER
9B5 MATCH
BOTTOM STRIP
CENTER STRIP
TOP STRIP
330Ω, 7W
1Ω, 1/4W
BLK
ORN-YEL
GRY-YEL
ORN-GRN
GRY-GRN
ORN-BLU
GRY-BLU
LIGHTING BOLT LAMPS (FRONT VIEW)
YEL
GRN
BLU
RED
CREDITS / BALL IN PLAY
STROBE 1
STROBE 9
STROBE 1
STROBE 9
5J5



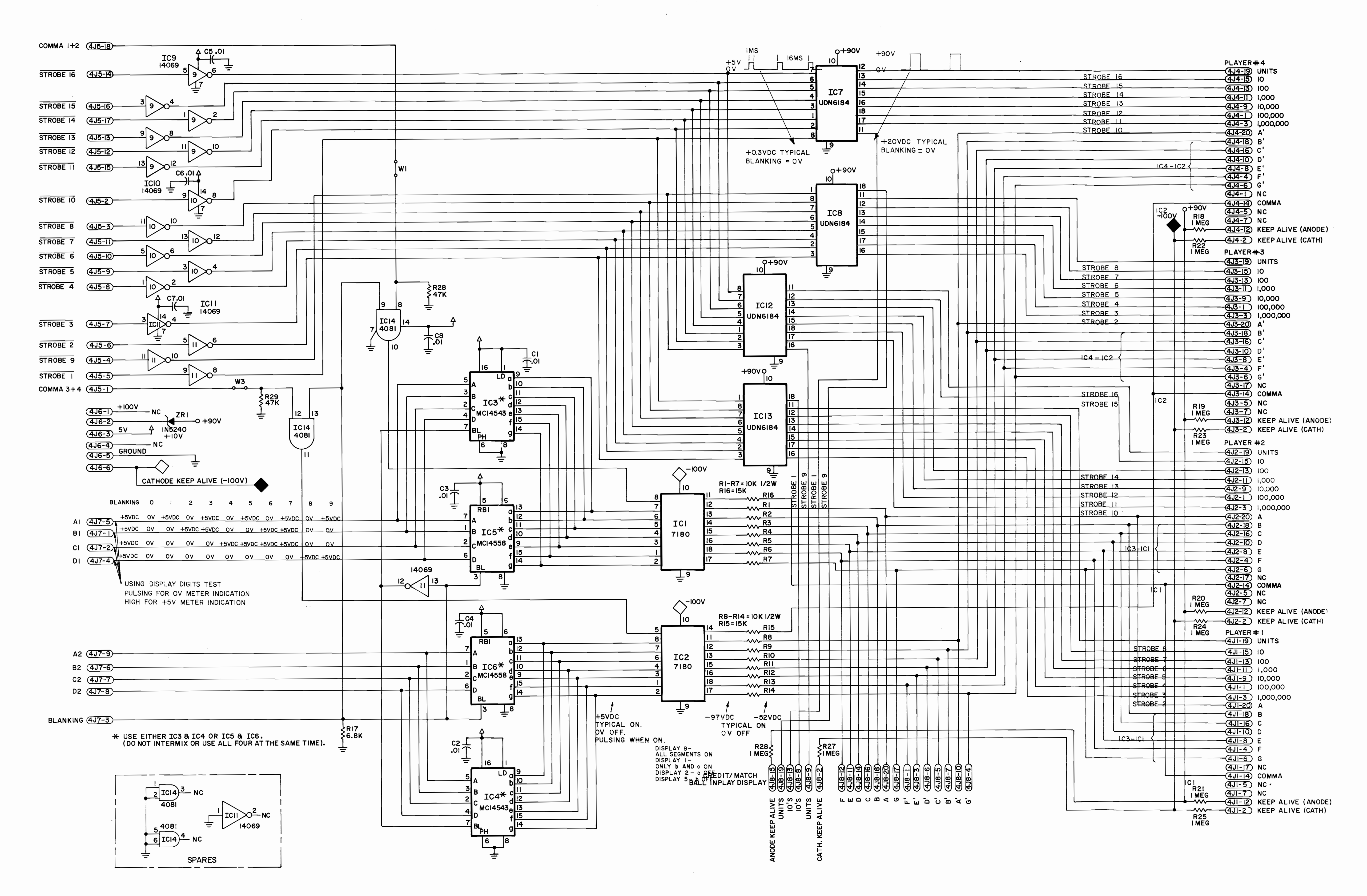
BILL OF MATERIAL

ITEM NO.	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D NO.
1	5760-09461		BARE P.C. BOARD	1
2	5310-08971	IC9,IC10,IC11	MC14069 HEX INVERTER	3
3	5310-08970	IC3, IC4	MC14543 BCD TO SEVEN SEGMENT LATCH/DECODER/DRIVER	2
4	5680-08969	IC1, IC2	UDN-7180 GAS DISCHARGE DISPLAY SEGMENT DRIVER	2
5	5680-08968	IC7,IC8,IC12,IC13	UDN-6184A OR UDN-6118A GAS DISCHARGE DISPLAY SEGMENT DR.	4
6	5310-09450	IC14	MC14081 QUAD 2-INPUT AND GATE	1
7	5010-08981	R1-R14	RESISTOR,FC,10K OHM, 5%, 1/2 WATT	14
8	5075-09135	ZR1	IN4740A ZENER DIODE 10V, 5%, 1 WATT	1
9	5043-08980	C1,C2 C5 THRU C8	CAPACITOR, CERAMIC, 0.01 MFD., 50V, +80 -20%	6
10	5010-09035	R28, R29	RESISTOR, FC,47K OHM, 5%, 1/4 WATT	2
11	5010-09086	R17	RESISTOR, FC, 6.8K OHM, 5%, 1/4 WATT	1
12	5010-08982	R18 THRU R27	RESISTOR, FC, 3 MEG. OHM, 5%, 1/4 WATT	10
13	5791-09437	J1 THRU J4, J8	20 PIN RIBBON HEADER	5
14	5010-09149	R15, R16	RESISTOR, FC, 15K OHM, 5%, 1/2 WATT	2
15	5010-09534	W1, W3	RESISTOR, 0 OHM	2

DIGIT CROSS REFERENCE

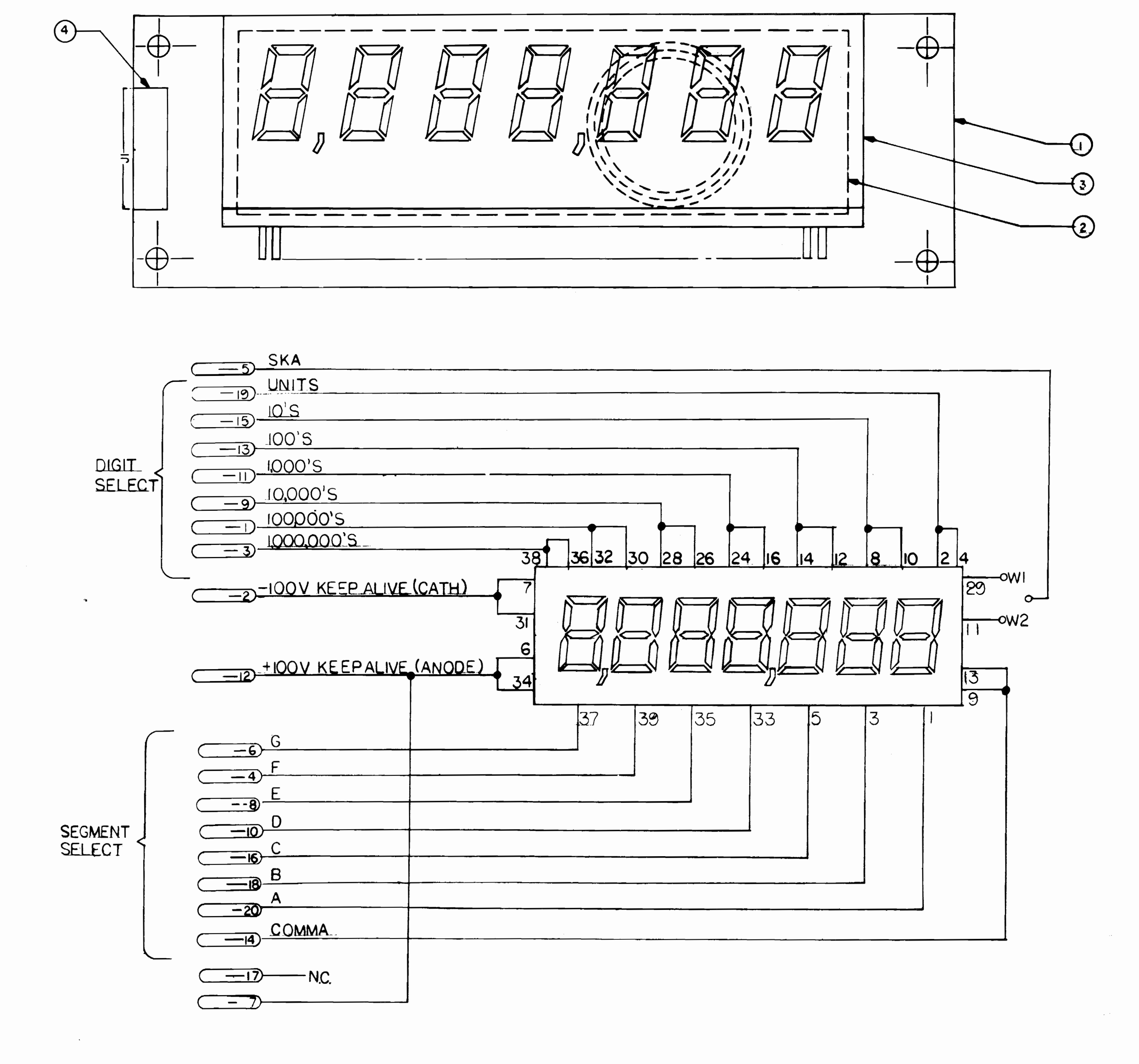
DIGIT	7-SEGMENT DECODER/DRIVER	STROBE (DRIVER)
Credit 10's	IC4/IC2	1 (IC13)
Credit Units	IC4/IC2	9 (IC12)
Match 10's	IC3/IC1	1 (IC7)
Match Units	IC3/IC1	9 (IC8)
#1 1,000,000	IC3/IC1	2 (IC13)
#1 100,000's	IC3/IC1	3 (IC13)
#1 10,000's	IC3/IC1	4 (IC13)
#1 1,000's	IC3/IC1	5 (IC13)
#1 100's	IC3/IC1	6 (IC13)
#1 10's	IC3/IC1	7 (IC13)
#1 Units	IC3/IC1	8 (IC13)
#2 1,000,000's	IC3/IC1	10 (IC12)
#2 100,000's	IC3/IC1	11 (IC12)
#2 10,000's	IC3/IC1	12 (IC12)
#2 1,000's	IC3/IC1	13 (IC12)
#2 100's	IC3/IC1	14 (IC12)
#2 10's	IC3/IC1	15 (IC12)
#2 Units	IC3/IC1	16 (IC12)
#3 1,000,000's	IC4/IC2	2 (IC8)
#3 100,000's	IC4/IC2	3 (IC8)
#3 10,000's	IC4/IC2	4 (IC8)
#3 1,000's	IC4/IC2	5 (IC8)
#3 100's	IC4/IC2	6 (IC8)
#3 10's	IC4/IC2	7 (IC8)
#3 Units	IC4/IC2	8 (IC8)
#4 1,000,000's	IC4/IC2	10 (IC7)
#4 100,000's	IC4/IC2	11 (IC7)
#4 10,000's	IC4/IC2	12 (IC7)
#4 1,000's	IC4/IC2	13 (IC7)
#4 100's	IC4/IC2	14 (IC7)
#4 10's	IC4/IC2	15 (IC7)
#4 Units	IC4/IC2	16 (IC7)
#1 Comma	–/IC1	2,5 (IC13)
#2 Comma	–/IC2	10,13 (IC12)
#3 Comma	–/IC1	2,5 (IC8)
#4 Comma	–/IC2	10,13 (IC7)

C 8363 Master Display Board Assembly Drawing



C 8363 Master Display Board Logic Diagram

BILL OF MATERIAL				
ITEM	PART NO.	PART DESIGNATION	DESCRIPTION	REQ'D.
1	5762-09448-XP		SLAVE DISPLAY P.C. BOARD	1
2	23-6545		DISPLAY MTG ADHESIVE FOAM	1
3	5670-09438-XP		7 DIGIT DISPLAY	1
4	5791-09438-XP	J1	20 PIN RIBBON HEADER	1
5	03-7573-2		CAPLUG	1

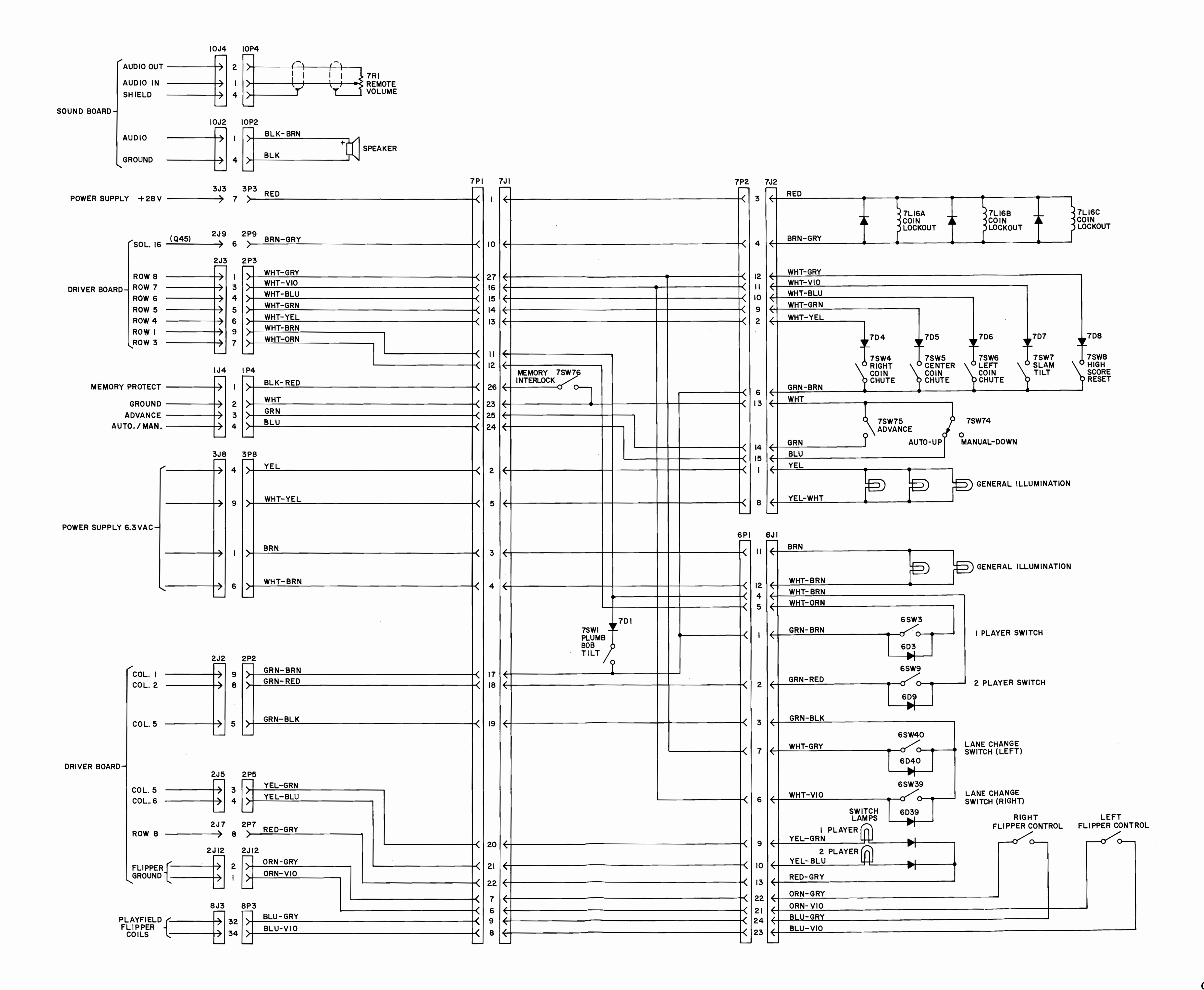


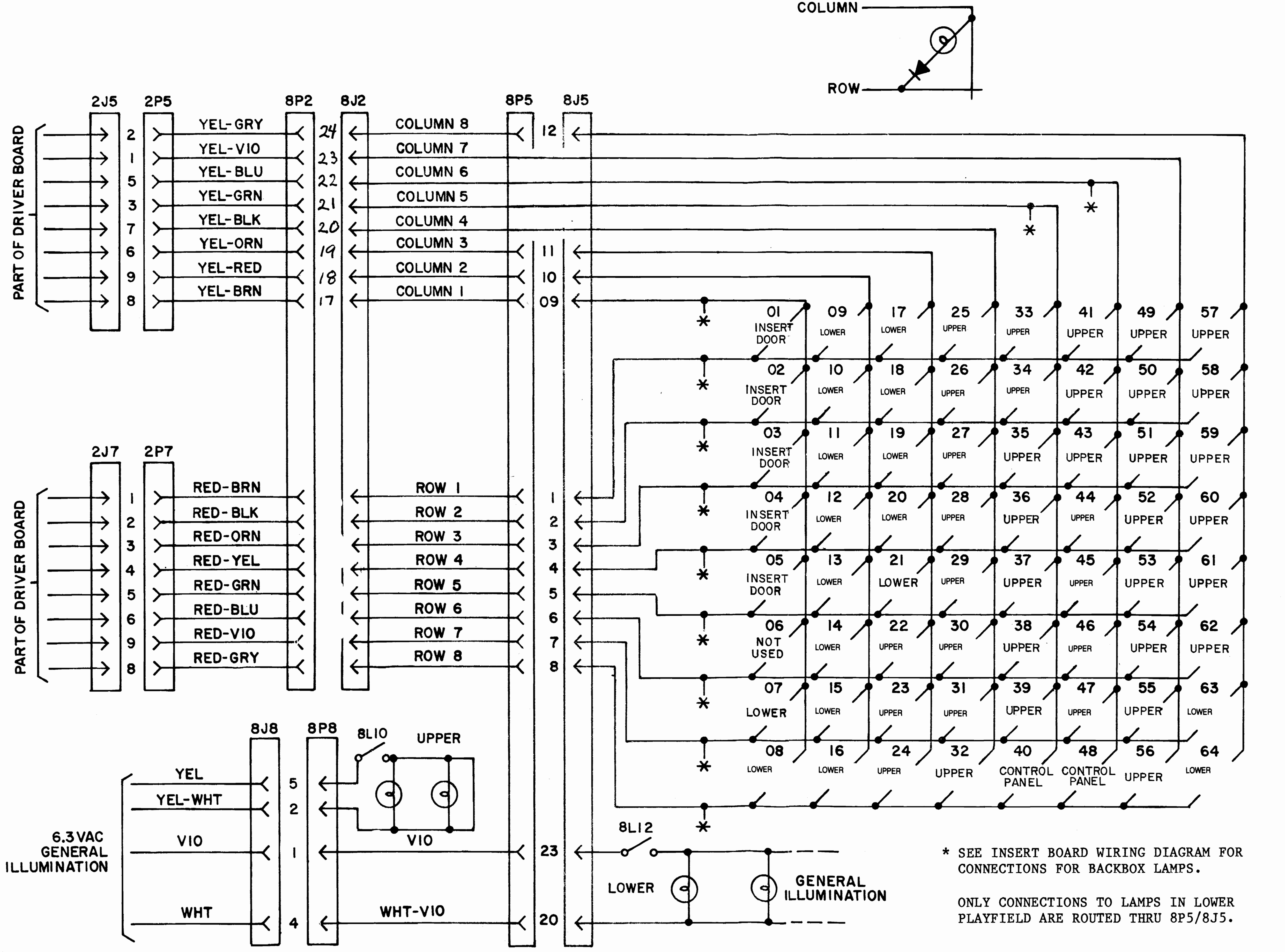
C 8364 PLAYER SLAVE DISPLAY

BILL OF MATERIAL				
ITEM	PART NO.	PART DESIGNATION	DESCRIPTION	REQ' D
1	5767-09468-00		CREDIT/MATCH SLAVE P.C. BOARD	1
2	23-6545		FOAM DISPLAY - BACK	1
3	5670-09448-00		4 DIGIT DISPLAY	1
4	5791-09438-00	J1	20 PIN RIBBON HEADER	1
5	23-6546		FOAM DISPLAY - FRONT	1
6	03-7573-2		CAPLUG	1

DIGIT SELECT
UNITS
10'S
SEGMENT SELECT
A'
B'
C'
D'
E'
F'
G'
-100V KEEP ALIVE (CATH)
+100V KEEP ALIVE (ANODE)
SEGMENT SELECT
G
F
E
D
C
B
A
DIGIT SELECT
UNITS
10'S

C 8365 CREDIT/MATCH SLAVE DISPLAY


SOUND BOARD
AUDIO OUT
AUDIO IN
SHIELD
AUDIO
GROUND
10J4
10P4
7R1 REMOTE VOLUME
10J2
10P2
BLK-BRN
BLK
SPEAKER
POWER SUPPLY +28V
3J3
3P3
RED
7P1
7J1
7P2
7J2
SOL. 16
(Q45)
2J9
2P9
BRN-GRY
7L16A COIN LOCKOUT
7L16B COIN LOCKOUT
7L16C COIN LOCKOUT
DRIVER BOARD
ROW 8
ROW 7
ROW 6
ROW 5
ROW 4
ROW 1
ROW 3
2J3
2P3
WHT-GRY
WHT-VIO
WHT-BLU
WHT-GRN
WHT-YEL
WHT-BRN
WHT-ORN
7D4
7D5
7D6
7D7
7D8
7SW4 RIGHT COIN CHUTE
7SW5 CENTER COIN CHUTE
7SW6 LEFT COIN CHUTE
7SW7 SLAM TILT
7SW8 HIGH SCORE RESET
MEMORY PROTECT
GROUND
ADVANCE
AUTO./MAN.
1J4
1P4
BLK-RED
WHT
GRN
BLU
MEMORY INTERLOCK
7SW76
GRN-BRN
7SW75 ADVANCE
7SW74
AUTO-UP
MANUAL-DOWN
POWER SUPPLY 6.3VAC
3J8
3P8
YEL
WHT-YEL
BRN
WHT-BRN
YEL-WHT
GENERAL ILLUMINATION
6P1
6J1
WHT-ORN
7D1
7SW1 PLUMB BOB TILT
6SW3
6D3
1 PLAYER SWITCH
6SW9
6D9
2 PLAYER SWITCH
GRN-RED
GRN-BLK
6SW40
6D40
LANE CHANGE SWITCH (LEFT)
6SW39
6D39
LANE CHANGE SWITCH (RIGHT)
COL. 1
COL. 2
COL. 5
2J2
2P2
COL. 5
COL. 6
2J5
2P5
YEL-GRN
YEL-BLU
ROW 8
2J7
2P7
RED-GRY
FLIPPER GROUND
2J12
ORN-GRY
ORN-VIO
SWITCH LAMPS
1 PLAYER
2 PLAYER
RIGHT FLIPPER CONTROL
LEFT FLIPPER CONTROL
PLAYFIELD FLIPPER COILS
8J3
8P3
BLU-GRY
BLU-VIO

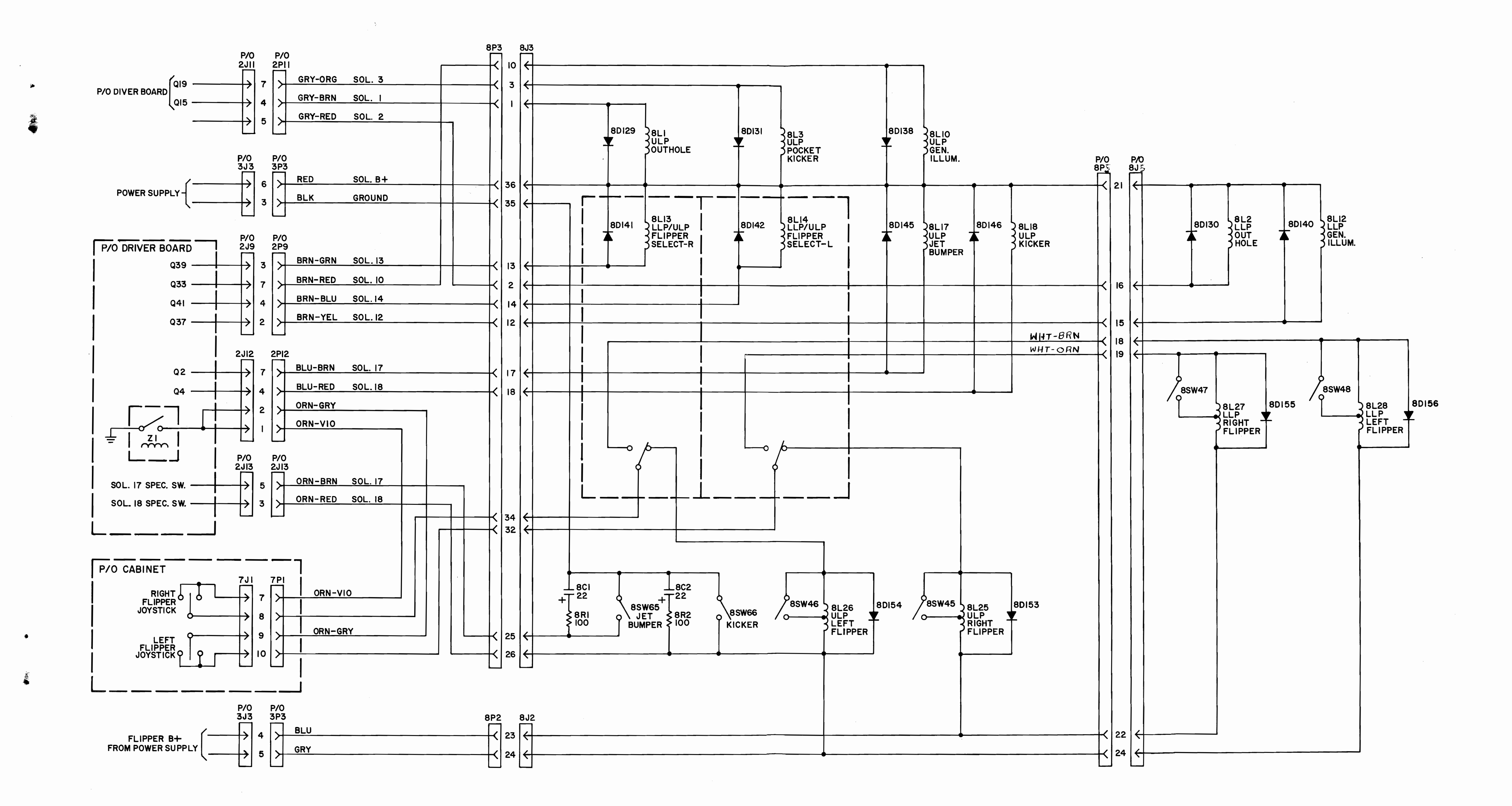


Lamp No.	Function
01	Same Player Shoots Again
02	Ball in Play
03	Tilt
04	Game Over
05	Match
06	Not Used
07	Arrow, LLP
08	A Arrow, LLP
09	2X Bonus Multiplier, LLP
10	3X Bonus Multiplier, LLP
11	4X Bonus Multiplier, LLP
12	5X Bonus Multiplier, LLP
13	20 Bonus, LLP, (20,000)
14	40 Bonus, LLP, (40,000)
15	60 Bonus, LLP, (60,000)
16	80 Bonus, LLP, (80,000)
17	6 Target LLP
18	7 Target LLP
19	8 Target LLP
20	9 Target LLP
21	10 Target LLP
22	5 Target ULP
23	4 Target ULP
24	3 Target ULP
25	2 Target ULP
26	1 Target ULP
27	Extra Ball, ULP
28	1K Bonus, ULP
29	2K Bonus, ULP
30	4K Bonus, ULP
31	8K Bonus, ULP
32	16K Bonus, ULP
33	2X Bonus Multiplier, ULP
34	3X Bonus Multiplier, ULP
35	5X Bonus Multiplier, ULP
36	10X Bonus Multiplier, ULP
37	Jet Bumper 30, ULP
38	Jet Bumper 300, ULP
39	Jet Bumper 3000, ULP
40	1-Player Start Button (Front Panel)
41	Lane A, ULP
42	Lane V, ULP
43	Flipper Return Lane R, ULP
44	K, ULP
45	O, ULP
46	N, ULP
47	Spinner 1000, ULP
48	2-Player Start Button (Front Panel)
49	Ramp Chamber Lane 5,000, ULP
50	Ramp Chamber Lane 10,000, UL-P 51 Ramp Chamber Lane 15,00L0, ULP
52	Ramp Chamber Lane 20,000, ULP
53	Jet Bumper, ULP
54	Spinner Ramp, ULP (Nearest Spinner)
55	Spinner Ramp, ULP
56	Spinner Ramp, ULP
57	Spinner Ramp, ULP
58	Ramp Chamber Lane, ULP
59	Spinner Ramp, ULP
60	Spinner Ramp, ULP
61	Spinner Ramp, ULP (Nearest Ramp Chamber)
62	Extra Ball 25,000, ULP
*63	Left EYE Special, LLP
*64	Right EYE Special, LLP

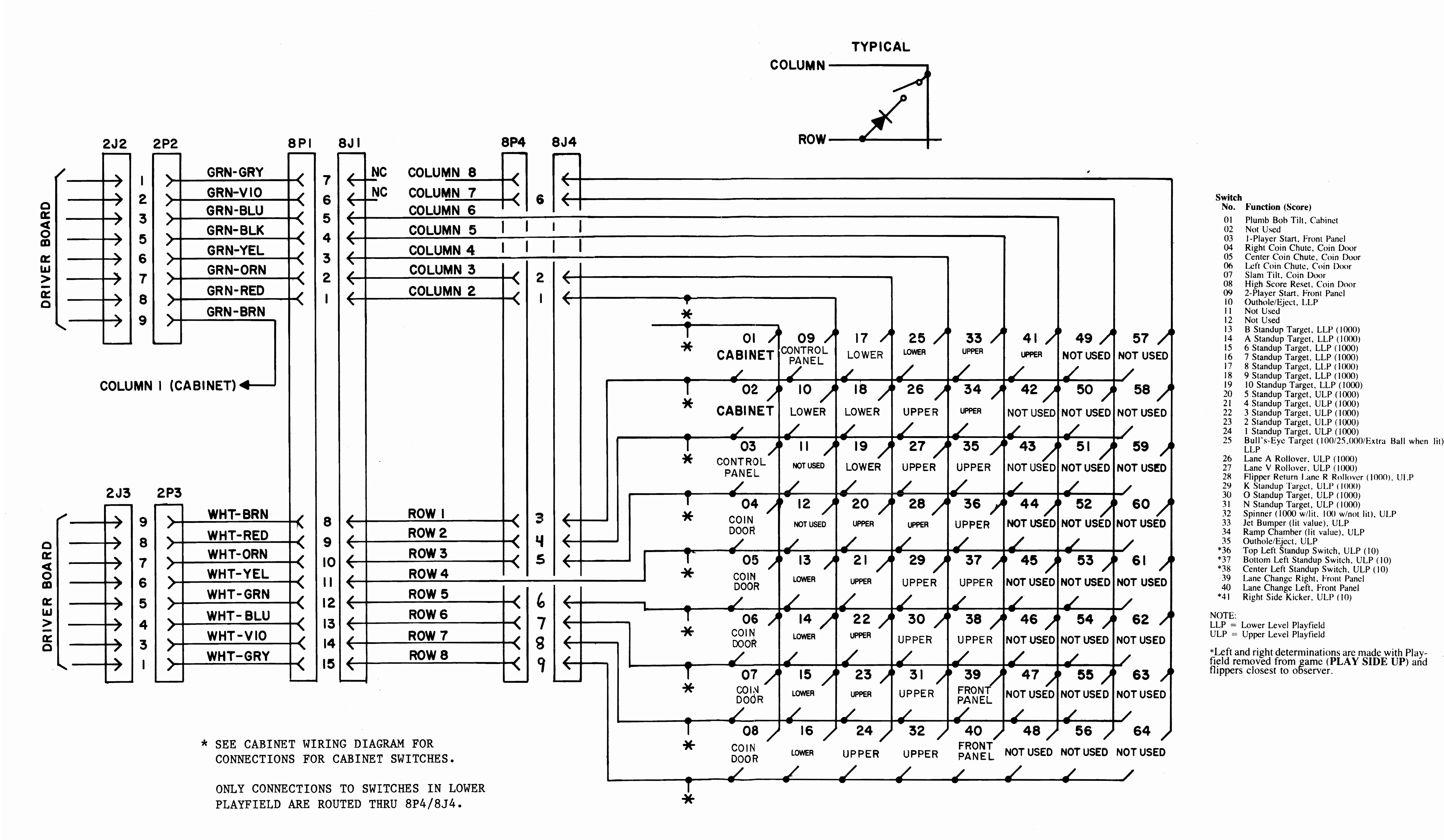
NOTE:
LLP = Lower Level Playfield
ULP = Upper Level Playfield

*Left and right determinations are made with Playfield removed from game (**PLAY SIDE UP**) and flippers closest to observer.

Playfield Lamp Wiring Diagram



Solenoid Wiring Diagram



Switch No.	Function (Score)
01	Plumb Bob Tilt, Cabinet
02	Not Used
03	1-Player Start, Front Panel
04	Right Coin Chute, Coin Door
05	Center Coin Chute, Coin Door
06	Left Coin Chute, Coin Door
07	Slam Tilt, Coin Door
08	High Score Reset, Coin Door
09	2-Player Start, Front Panel
10	Outhole/Eject, LLP
11	Not Used
12	Not Used
13	B Standup Target, LLP (1000)
14	A Standup Target, LLP (1000)
15	6 Standup Target, LLP (1000)
16	7 Standup Target, LLP (1000)
17	8 Standup Target, LLP (1000)
18	9 Standup Target, LLP (1000)
19	10 Standup Target, LLP (1000)
20	5 Standup Target, ULP (1000)
21	4 Standup Target, ULP (1000)
22	3 Standup Target, ULP (1000)
23	2 Standup Target, ULP (1000)
24	1 Standup Target, ULP (1000)
25	Bull's-Eye Target (100/25,000/Extra Ball when lit) LLP
26	Lane A Rollover, ULP (1000)
27	Lane V Rollover, ULP (1000)
28	Flipper Return Lane R Rollover (1000), ULP
29	K Standup Target, ULP (1000)
30	O Standup Target, ULP (1000)
31	N Standup Target, ULP (1000)
32	Spinner (1000 w/lit, 100 w/not lit), ULP
33	Jet Bumper (lit value), ULP
34	Ramp Chamber (lit value), ULP
35	Outhole/Eject, ULP
*36	Top Left Standup Switch, ULP (10)
*37	Bottom Left Standup Switch, ULP (10)
*38	Center Left Standup Switch, ULP (10)
39	Lane Change Right, Front Panel
40	Lane Change Left, Front Panel
*41	Right Side Kicker, ULP (10)

NOTE:
LLP = Lower Level Playfield
ULP = Upper Level Playfield

*Left and right determinations are made with Playfield removed from game (**PLAY SIDE UP**) and flippers closest to observer.